State of California
THE RESOURCES AGENCY
Department of Water Resources

BULLETIN No. 142-1

WATER RESOURCES AND FUTURE WATER REQUIREMENTS

NORTH COASTAL HYDROGRAPHIC AREA

Volume I: Southern Portion

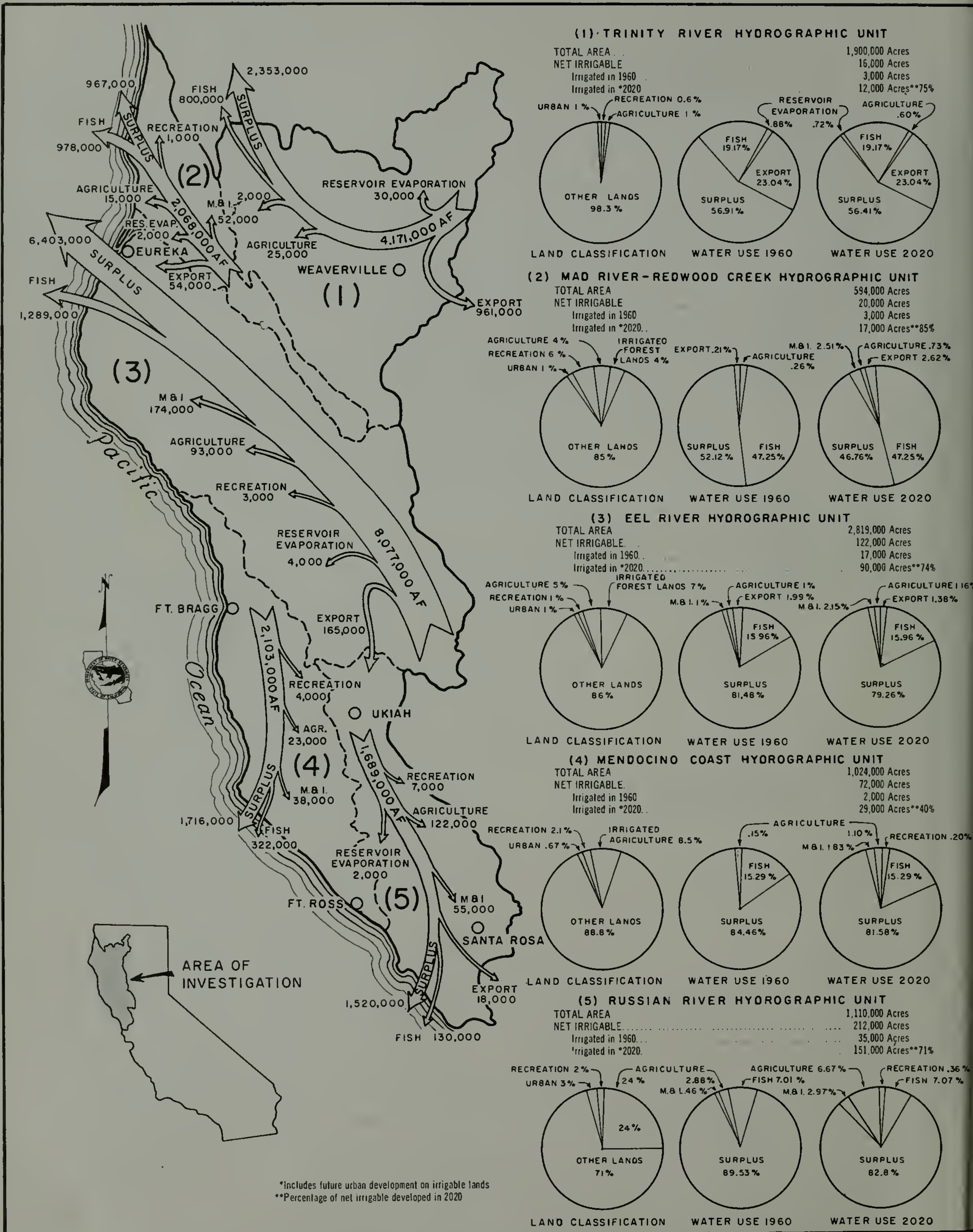
Preliminary Edition

APRIL 1965

HUGO FISHER
Administrator
The Resources Agency

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources



WATER RESOURCES AND FUTURE WATER REQUIREMENTS
NORTH COASTAL HYDROGRAPHIC AREA—SOUTHERN PORTION
NET CONDITIONS ESTIMATED FOR YEAR 2020

State of California
THE RESOURCES AGENCY
Department of Water Resources

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FOREWORD

This report, the first of the Bulletin No. 142 series, is a preliminary report on the water resources and water requirements of the southern portion of the North Coastal Area of California. It contains monthly streamflows, information on the availability of ground water, and the quality characteristics of both surface and ground water. It also contains estimates of future land use, water requirements, and the annual water surpluses or deficiencies for each unit or subunit based on probable future population increases, and urban, agricultural, industrial, and recreational developments. Surpluses indicate the quantities of water available for storage or export, while deficiencies indicate the amount of water that could be imported, or the amount of storage required to meet future local needs.

The Department of Water Resources will use these data in its planning activities and in staging future water projects.

In 1956 the department was given the responsibility of gathering and compiling basic data on water and land use, land classification, streamflows, ground water, and water quality, when the Legislature declared:

> "... that in providing for the full development and utilization of the water resources of this State, it is necessary to obtain for consideration by the Legislature and the people, information as to the water which can be made available for exportation from the watershed in which it originates without depriving those watersheds of the water necessary for beneficial use therein...."

Basic data are being gathered and compiled for the major hydrographic areas and hydrographic units within the State and will be presented in two series of reports.

Bulletin No. 94 series contains data on land classification, and present land and water use.

Bulletin No. 142 series contains data on the water resources and water requirements for hydrographic areas or major portions thereof.

A public hearing will be held following publication of a preliminary edition of each report, and the final edition will reflect pertinent comments from these hearings, and such revisions as may be necessary.

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E OF CALIFORNIA—RESOURCES AGENCY WILLIAM E. WARNE, Director

PARTMENT OF WATER RESOURCES
BOX 388
RAMENTO

December 3, 1964

Honorable Edmund G. Brown, Governor
and Members of the Legislature
of the State of California

Gentlemen:

I have the honor to transmit the preliminary edition of Bulletin No. 142-1, "Water Resources and Future Water Requirements, North Coastal Hydrographic Area, Volume I: Southern Portion." This is the first of a series of reports on water resources and future water requirements resulting from studies conducted pursuant to legislation codified under Section 232 of the Water Code. The information contained in this series of reports will provide a basis for staging the future projects needed to supply water for the State's increasing population and its expanding agricultural, industrial, and recreational developments.

This report presents detailed data on streamflows and estimates of future water requirements of an 11,600 square mile area of Northwestern California. The report indicates that in the year 2020 the area will have an overall average annual water surplus of about 13,000,000 acre-feet after local requirements have been met. The report also indicates that deficiencies will occur in many areas during the summer months.

Shortly after distribution of this report, public hearings will be held to receive the comments of evervone who may be concerned with the material presented.

Sincerely yours,

William E. Warne

Director

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

EDMUND G. BROWN, Governor
HUGO FISHER, ADMINISTRATOR, The Resources Agency
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WILLIAM M. CARAH
Executive Secretary

ORVILLE L. ABBOTT
Engineer

ACKNOWLEDGMENT

For the assistance supplied by individuals, water agencies, cities and counties in the North Coast area, and various agencies of the state and federal governments, the Department of Water Resources is deeply grateful.

CHAPTER I

INTRODUCTION

This report presents a quantitative comparison of the water resources and probable future water requirements within five hydrographic units which contain about 11,600 square miles in the North Coastal Hydrographic Area of California.

The information compiled in this bulletin has been summarized from a series of investigations, each conducted as an integral part of the Coordinated Statewide Planning Program, whose basic objective is to provide a broad statewide concept of the timing, needs, and sequence of development of California's water resources.

Determination of existing water resources, present water use, future water requirements, and water surplus or deficiency is essential in the accomplishment of this purpose, as are considerations of limitations which may be imposed by the quality of water, and possible methods of water quality management.

This information furnishes a sound basis for decisions related to construction of water resources projects, and leads to logical assumptions regarding the most favorable economic sequence and timing for projects. Increasing water needs of the entire State require the development of this information from all areas, including, although not limited to, the North Coastal area, the Central Valley, the Central Coastal area, and Southern California. There are three phases of this program within the preview of the Coordinated Statewide Planning Program.

Coordinated Statewide Planning Program

The Coordinated Statewide Planning Program is conducted under the basic authorization contained in Section 232 of the California Water Code, wherein;

> "... the Department is authorized and directed to conduct investigations and hearings and to prepare findings therefrom and to report thereon to the Legislature at the earliest possible date with respect to the following matters:
>
> "(a) The boundaries of the respective watersheds of the State and the quantities of water originating therein;
>
> "(b) The quantities of water reasonably required for ultimate beneficial use in the respective watersheds;
>
> "(c) The quantities of water, if any, available for export from the respective watersheds;
>
> "(d) The areas which can be served by the water available for export from each watershed; and
>
> "(e) The present uses of water within each watershed together with the apparent claim of water right attaching thereto, excluding individual uses of water involving diversions of small quantities which, in the judgment of the Director of Water Resources, are insufficient in the aggregate to materially affect the quantitative determinations included in the report.
>
> "Before adopting any findings which are reported to the Legislature, the department shall hold public hearings after reasonable notice, at which all interested persons may be heard."

The first phase of the total program consists of the land and water use inventories reported in the Department of Water Resources Bulletin No. 94 series, which presents information on the boundaries of the watersheds, a field inventory of present land and water use, and a land classification survey. These bulletins have been compiled for each of the five hydrographic units contained in the study area reported in this bulletin. Similar work will be reported for all remaining areas of the State.

The second phase of the Coordinated Statewide Planning Program consists of a systematic evaluation by significant drainage basins of the quantity and quality of surface and underground water resources, estimates of timed future economic demands for water, and an appraisal of the resultant future water surpluses or deficiencies for each study area. The foregoing information is reported in the Department of Water Resources Bulletin No. 142 series, of which this bulletin is the first.

The third and final phase of the investigation will utilize the results of the first two phases, not only for the study area of this bulletin, but for all other areas of the State where similar investigations have been conducted, and will recommend specific projects together with their dates and sequence of construction in order to efficiently provide the water required to maintain and expand the whole of California's dynamic water-dependent economy.

Area Under Investigation

This report discusses the findings of the water resources and future water requirements phase of the Coordinated Statewide Planning Program for a portion of the North Coastal Hydrographic Area.

The study area reported in this bulletin consists of the southwesterly portion of the North Coastal Hydrographic Area.

Pictured on Figure 1, the area consists of the Trinity River, Mad River-Redwood Creek, Eel River, Russian River, and Mendocino Coast Hydrographic Units. The total included area is roughly triangular and contains about 11,600 square miles, bounded on the west by the Pacific Ocean, on the north by the drainage divide separating the Klamath River from Redwood Creek and Trinity River, and on the east and south by the drainage divide which separates the Central Valley and the north San Francisco Bay regions from the coastal stream basins. Each of the five hydrographic units is further subdivided into subunits which contain significant runoff or cultural characteristics.

Physiography and Regional Geology

The study area is extremely mountainous and is contained within the northern Coast Ranges and the southern portion of the Klamath Mountains, including the Trinity Mountains and the Trinity Alps. The area consists mostly of ridges and peaks cut by deeply incised stream valleys. The terrain, extending inland from the coast, becomes progressively more rugged, culminating with the Trinity Alps, the most rugged feature in the study area.

Long ridges and valleys trending generally north-northwest are characteristic of the Coast Ranges, which occupy most of the study area except the Trinity River Hydrographic Unit. This regional trend is caused by the consistent strike of faults, folds, and uplifted and down dropped blocks. River courses generally run west-of-north along the structural valleys, except for short reaches which cut across the grain. A few broad structural basins, such as Round Valley, are present. Regional trends in the Klamath Mountains are more varied, but within the study area are generally from northwest to north.

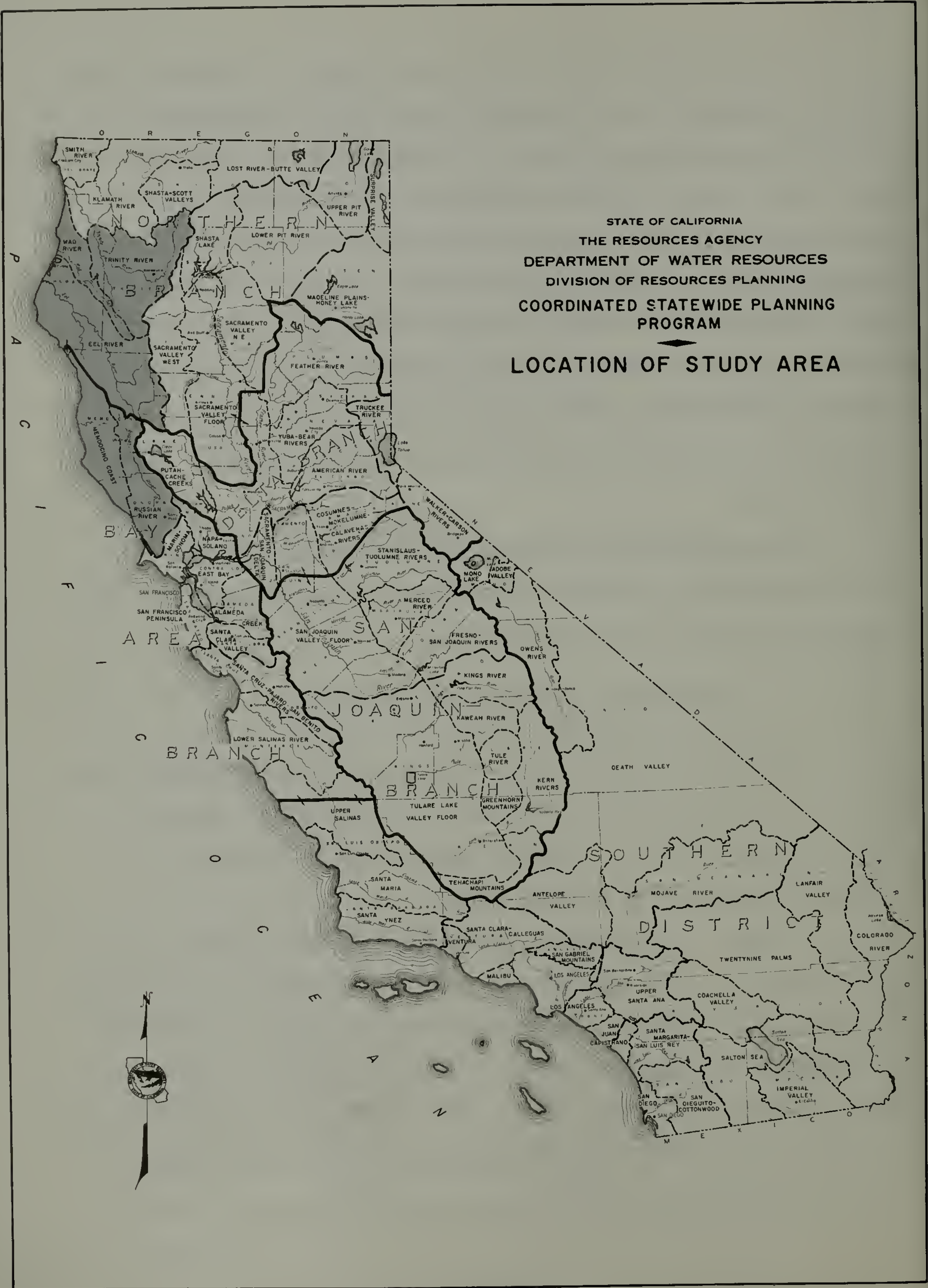
Rocks of the Klamath Mountains consist of Paleozoic and Mesozoic sedimentary and metamorphic rocks which have been intruded by granitics and ultra-mafic rocks including serpentine. Rocks in the northern Coast Ranges are mostly sandstone, shale, and conglomerate of the Franciscan Formation, but include some schist and serpentine. The Franciscan rocks are sheared, folded, and generally contorted to a very high degree. Less badly deformed sandstones and shales of the Yager and related formations also occur. In the western portion of the study area unconsolidated to semi-consolidated materials of Tertiary and Quaternary age are present in many places.

The hydrographic units and their subunits are shown on Plate I, and Tables 1 through 5 describe their sizes and locations within the counties of the study area.

Description of Hydrographic Units

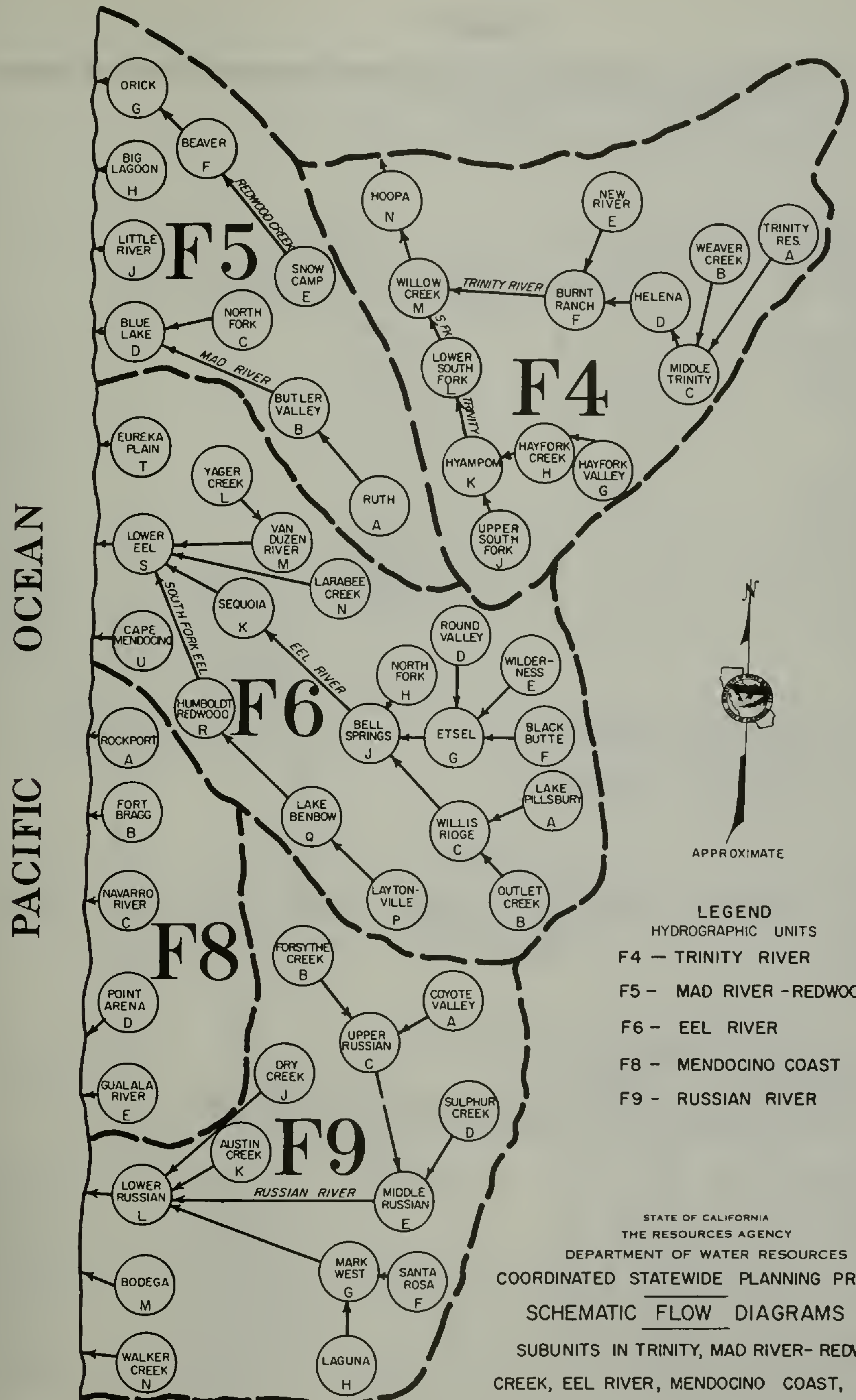
The five hydrographic units making up the portion of the North Coastal Hydrographic Area covered by this report are the Trinity River, Mad River-Redwood Creek, Eel River, Russian River, and Mendocino Coast Hydrographic Units.

Complete descriptions of each hydrographic unit, including amount of land and water use and classification of land in each unit may be found in the Bulletin No. 94 series published by the Department of Water Resources. These bulletins, with their complete titles, are listed in the bibliography, and each is referred to in the text covering the hydrographic units in this section.



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
COORDINATED STATEWIDE PLANNING PROGRAM

LOCATION OF STUDY AREA



APPROXIMATE

LEGEND
HYDROGRAPHIC UNITS

F4 — TRINITY RIVER
F5 — MAD RIVER - REDWOOD CREEK
F6 — EEL RIVER
F8 — MENDOCINO COAST
F9 — RUSSIAN RIVER

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
COORDINATED STATEWIDE PLANNING PROGRAM

SCHEMATIC FLOW DIAGRAMS

SUBUNITS IN TRINITY, MAD RIVER- REDWOOD CREEK, EEL RIVER, MENDOCINO COAST, AND RUSSIAN RIVER HYDROGRAPHIC UNITS.

TABLE 1

AREAS OF SUBUNITS IN TRINITY RIVER HYDROGRAPHIC UNIT BY COUNTIES
(In Acres)

Hydrographic Subunits	Reference Number Plate 2	Counties		Total
		Trinity	Humboldt	
Trinity Reservoir	F-4 - A	459,800		459,800
Weaver Creek	F-4 - B	31,800		31,800
Middle Trinity	F-4 - C	157,000		157,000
Helena	F-4 - D	176,900		176,900
New River	F-4 - E	150,300		150,300
Burnt Ranch	F-4 - F	134,600		134,600
Hayfork Valley	F-4 - G	172,200		172,200
Hayfork Creek	F-4 - H	70,300		70,300
Upper South Fork	F-4 - J	219,500		219,500
Hyampom	F-4 - K	24,000	3,900	27,900
Lower South Fork	F-4 - L	37,600	68,800	106,400
Willow Creek	F-4 - M	1,800	38,900	40,700
Hoopa	F-4 - N		152,800	152,800
Total		1,635,800	264,400	1,900,200

TABLE 2

AREAS OF SUBUNITS IN MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT
BY COUNTIES
(In Acres)

Hydrographic Subunits	Reference Number Plate 2	Counties		Total
		Trinity	Humboldt	
Ruth	F-5 - A	91,300		91,300
Butler Valley	F-5 - B	10,000	150,000	160,000
North Fork	F-5 - C		29,900	29,900
Blue Lake	F-5 - D		41,900	41,900
Snow Camp	F-5 - E		43,300	43,300
Beaver	F-5 - F		68,400	68,400
Orick	F-5 - G		76,300	76,300
Big Lagoon	F-5 - H		54,000	54,000
Little River	F-5 - J		29,300	29,300
Total		101,300	493,100	594,400

TABLE 3

AREAS OF SUBUNITS IN EEL RIVER HYDROGRAPHIC UNIT BY COUNTIES
(In Acres)

Hydrographic Subunits	Reference Number Plate 2	Counties					Total
		Trinity	Humboldt	Mendocino	Glenn	Lake	
Lake Pillsbury	F-6 - A			20,200	13,900	188,100	222,200
Outlet Creek	F-6 - B			104,300			104,300
Willis Ridge	F-6 - C			127,000		200	127,200
Round Valley	F-6 - D			82,600			82,600
Wilderness	F-6 - E	75,800		55,600			131,400
Black Butte	F-6 - F			62,100	39,600	2,200	103,900
Etsel	F-6 - G			163,900		200	164,100
North Fork	F-6 - H	124,200		57,200			181,400
Bell Springs	F-6 - J	54,500	42,200	117,600			214,300
Sequoia	F-6 - K	24,400	95,400				119,800
Yager Creek	F-6 - L		84,600				84,600
Van Duzen River	F-6 - M	40,100	149,700				189,800
Larabee Creek	F-6 - N		53,900				53,900
Laytonville	F-6 - P			80,100			80,100
Lake Benbow	F-6 - Q		102,900	161,100			264,000
Humboldt Redwood	F-6 - R		97,400				97,400
Lower Eel	F-6 - S		137,100				137,100
Eureka Plain	F-6 - T		141,200				141,200
Cape Mendocino	F-6 - U		311,300	8,000			319,300
Total		319,000	1,215,700	1,039,700	53,500	190,700	2,818,600

TABLE 4

AREAS OF SUBUNITS IN MENDOCINO COAST HYDROGRAPHIC UNIT BY COUNTIES
(In Acres)

Hydrographic Subunits	Reference Number Plate 2	Counties		Total
		Mendocino	Sonoma	
Rockport	F-8 - A	146,700		146,700
Fort Bragg	F-8 - B	279,500		279,500
Navarro River	F-8 - C	201,900		201,900
Point Arena	F-8 - D	173,400		173,400
Gualala River	F-8 - E	68,600	153,600	222,200
Total		870,100	153,600	1,023,700

TABLE 5

AREAS OF SUBUNITS IN RUSSIAN RIVER HYDROGRAPHIC UNIT BY COUNTIES
(In Acres)

Hydrographic Subunits	Reference Number Plate 2	Counties				Total
		Mendocino	Sonoma	Marin	Lake	
Coyote Valley	F-9 - A	66,500			700	67,200
Forsythe Creek	F-9 - B	53,500				53,500
Upper Russian	F-9 - C	198,800			2,000	200,800
Sulphur Creek	F-9 - D	3,100	48,900		200	52,200
Middle Russian	F-9 - E	9,300	124,000			133,300
Santa Rosa	F-9 - F		50,100			50,100
Laguna	F-9 - G		56,600			56,600
Mark West	F-9 - H		55,700			55,700
Dry Creek	F-9 - J	26,100	112,900			139,000
Austin Creek	F-9 - K		44,700			44,700
Lower Russian	F-9 - L		97,400			97,400
Bodega	F-9 - M		72,400	23,900		96,300
Walker Creek	F-9 - N		2,600	60,600		63,200
Total		357,300	665,300	84,500	2,900	1,110,000

Trinity River Hydrographic Unit

This hydrographic unit lies within the Klamath River Basin of the North Coastal Hydrographic Area, and contains the entire watershed of the Trinity River. The Trinity River rises in rugged canyons between the Scott Mountains on the northwest and the Eddy's on the east, flows generally south and west more than 80 miles to Douglas City and then generally northwest and north for more than 100 miles to its junction with the Klamath River at Weitchpec.

The hydrographic unit boundary follows the ridges separating the drainage area of the Trinity River from the adjacent watersheds of the Klamath, Salmon, Scott, and Shasta Rivers on the north; the Sacramento River, Clear Creek, and Cottonwood Creek on the southeast; and the Mad River and Redwood Creek on the southwest.

The Trinity River Hydrographic Unit has been divided into 13 subunits, locations of which are shown on Plate I, and the area of each is shown in Table 1.

For a complete description of the hydrographic unit, see Bulletin No. 94-2.

Mad River-Redwood Creek Hydrographic Unit

The Mad River-Redwood Creek Hydrographic Unit is a narrow land area approximately 90 miles long with a maximum width of 20 miles and a minimum width of less than 5 miles. The unit is bordered by the watersheds of the Klamath and Trinity on the north and east, and those of the Eel and Van Duzen Rivers, and Humboldt

Bay on the south, and contains the entire drainage area of the Mad River and Redwood Creek. The hydrographic unit occupies portions of Humboldt and Trinity Counties.

This hydrographic unit has been subdivided into nine subunits which are shown on Plate I and described in Table 2.

For a complete description of this hydrographic unit, see Bulletin No. 94-7.

Eel River Hydrographic Unit

This hydrographic unit is the largest of the five hydrographic units comprising the study area of this report and extends for a distance of nearly 140 miles in a northwesterly direction from its southern tip 10 miles northeast of Clear Lake to its northermost point near the mouth of the Mad River, 10 miles north of Eureka. The hydrographic unit has a maximum width of 40 miles and an average width of about 32 miles. It has been subdivided into 19 subunits. The hydrographic unit contains the entire drainage area of the Eel River, the drainage areas of the Bear and Mattole Rivers in the vicinity of Cape Mendocino, and the drainage area tributary to Humboldt Bay. The areas and locations of the subunits contained within this hydrographic unit are shown on Plate I and described in Table 3.

For a complete description of this hydrographic unit, see Bulletin No. 94-8.

Mendocino Coast Hydrographic Unit

The Mendocino Coast Hydrographic Unit consists of a series of small separate drainage basins, each of which is generally parallel to the other and contributes directly to the Pacific Ocean. The hydrographic unit is contained within the coastal portion of Mendocino County, and the northwest coastal drainage portion of Sonoma County. The eastern boundary of the hydrographic unit is the drainage divide of the Eel, Mattole, and Russian River Basins. The hydrographic unit is divided into five subunits, locations of which are shown on Plate I and described in Table 4. A complete description of this hydrographic unit is contained in Bulletin No. 94-10.

Russian River Hydrographic Unit

The Russian River Hydrographic Unit occupies portions of Mendocino, Sonoma, Lake, and Marin Counties. The unit is drained primarily by the Russian River and its tributaries. The hydrographic unit is bounded by the Mendocino Coast drainage on the west, the Eel River drainage on the north, the drainage of Putah and Cache Creeks and the Napa River on the east, and the drainage of Sonoma, Petaluma, and Lagunitas Creeks on the south. The unit has been divided into 13 subunits, locations of which are shown on Plate I and described in Table 5. A complete description of this hydrographic unit is contained in Bulletin No. 94-11.

Related Investigations

In addition to the Bulletin No. 94 series, already mentioned, and in conjunction with the studies undertaken in the preparation of this bulletin, the Department of Water Resources is conducting several similar investigations of water resources and future water requirements throughout the State.

Other Investigations of the Coordinated Statewide Planning Program

The statewide planning activity is currently developing information vital to the determination of future water requirements and evaluation of water resources available in several specific areas.

Determination of present and future supplemental water requirements of the Central Valley, San Francisco Bay Region, Monterey Coastal area, and Southern California is of particular interest and importance to the orderly study of water resource development.

Department of Water Resources Bulletin No. 142-2, "Water Resources and Future Water Requirements in the San Joaquin Valley Floor and Tulare Lake Valley Floor, 1964," contains estimates of the supplemental water requirement for the San Joaquin Valley.

A study is currently under way to evaluate present and future water requirements and to measure them against availability of future water supplies in the entire drainage area of the Sacramento River Basin, exclusive of the Upper and Lower Pit River Hydrographic Units. This study is scheduled for publication in 1967 and will be entitled Bulletin No. 142-3, "Water Resources and Future Water Requirements in Sacramento Valley Hydrographic Area."

The department also is presently studying estimates of future water requirements for metropolitan areas of Southern California, with publication scheduled for 1967. A similar study is in progress in the San Francisco Bay Area.

North Coastal Area Investigation

There are many facets in an investigation of water resources development. Two of these are of major significance in the North Coastal area.

First it is necessary to determine the amount of water available in an area, and to estimate how much of that water must be retained to meet anticipated future needs, growth, and development. Determination must also be made whether there is a present or future water surplus or deficiency in the area of origin. The present Bulletin No. 142-1 is concerned with these problems.

Secondly, investigation must be undertaken to explore the physical possibilities of water development in the area, to describe projects required, and construction needed to serve both local and export requirements.

The Department of Water Resources is currently preparing Bulletin No. 136, "North Coastal Area Investigation," which provides a general description of the investigation, outlines the objectives, activities, and conclusions of the investigation, and describes the physical plans which have been formulated. There are three individually bound appendixes to the bulletin and four individually bound office reports. The appendixes cover the subjects of watershed management in the Eel River Basin, recreation, and fish and game. The office reports cover alternative plans for development, design and cost estimates, engineering geology, and hydrology.

Bulletin No. 142-1:I and Bulletin No. 136 complement each other and in many instances utilize information that has been jointly acquired and evaluated.

Conduct of the Investigation

Because of the large size of the study area and the many factors which must be related in studies of water resources and water requirements, the investigation was divided into separate studies, according to subjects. This permits each separate study to proceed independently, with its findings made available for consideration in the analysis of water surplus or deficiency. Brief descriptions of these studies follow, under the general classifications of "Water Resources" and "Future Water Requirements." Figure 3 illustrates the interrelationship of these studies, and the sequence in which they were considered in the analyses.

Water Resources

1. Climatology. Climatologic information provides data on temperature and precipitation which are utilized in correlating stream gaging stations to provide missing streamflow data, as well as to determine the climatic adaptability of possible land use practices. These data are also valuable in determining amounts of applied irrigation water required to compensate for maldistribution or shortage of seasonal rainfall. The climatological studies provide the following specific information:

   a. Mean seasonal precipitation for representative stations.

   b. Mean seasonal isohyetal map.

   c. Seasonal variation of precipitation and temperature.

   d. Variation of precipitation and temperature with elevation.

   e. Length of the growing season.

WATER RESOURCES AND FUTURE WATER REQUIREMENTS — BULLETIN NO.142 SERIES

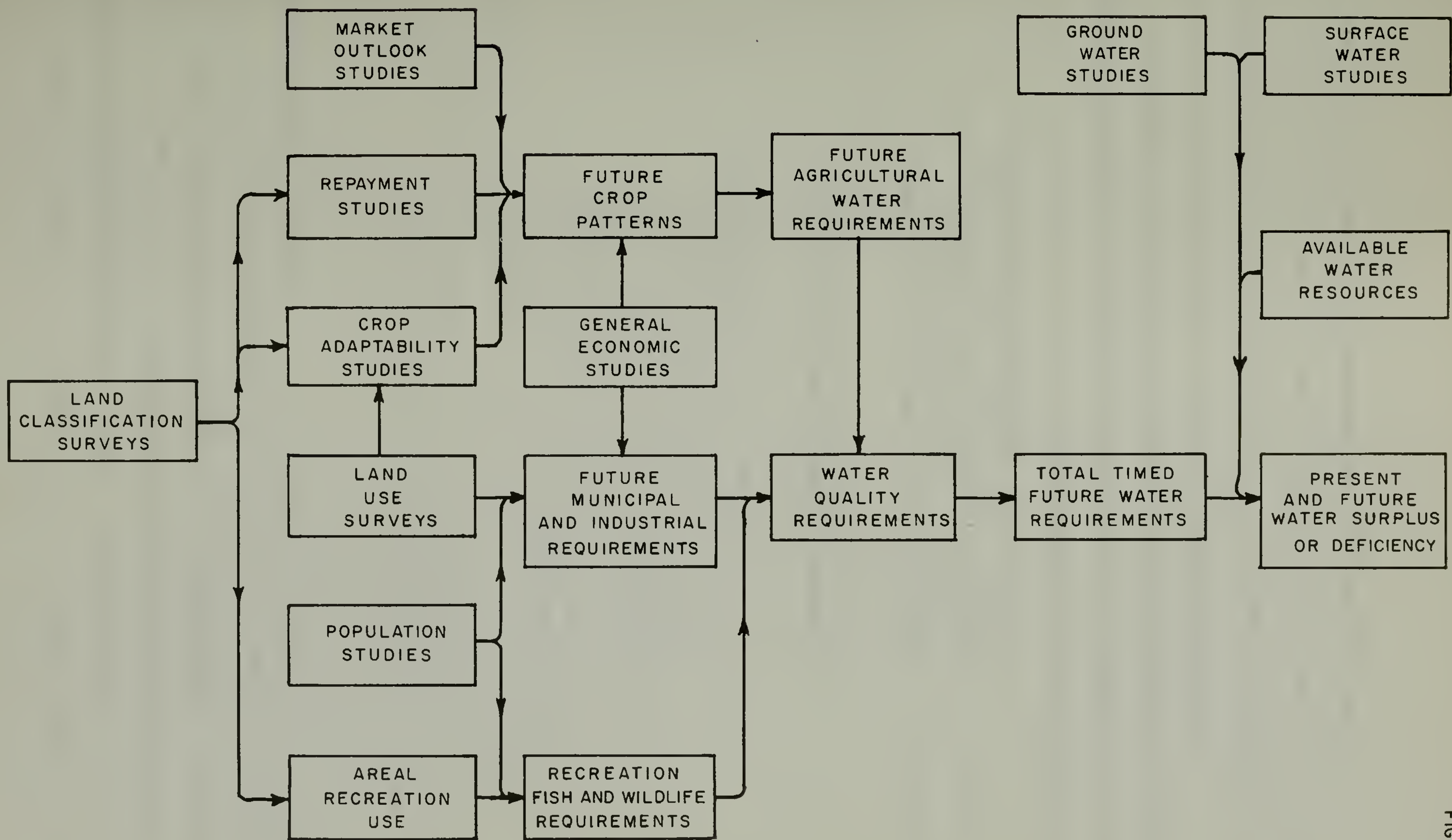


FIGURE 3

Items "a" and "b" are presented in Chapter II of this bulletin. Items "c", "d", and "e" are presented in detail for each hydrographic unit in the Bulletin No. 94 series of reports.

2. Surface Water Hydrology. The major effort to determine quantities of water available for use both within and outside the study area was concentrated in this phase of the study, which revealed the following data:

a. Recorded or estimated monthly and annual full natural flows for the 50-year period, 1910-11 through 1959-60, at all stream gaging stations with five or more years of record.

b. Flood frequency and flow duration curves for selected stations within each hydrographic unit.

c. An iso-runoff map showing generalized lines of equal mean seasonal depth of natural runoff for the 50-year period, 1910-11 through 1959-60.

d. Estimated 50-year mean seasonal natural runoff from ungaged drainage areas.

Each subunit's mean seasonal contribution to the runoff of the entire hydrographic unit was estimated from streamflow measurements or by study of the isohyetal maps, or both. This information was then distributed on a monthly basis according to the mean runoff conditions prevailing during the 50-year base period, thus providing a basis for determining the monthly water surpluses or deficiencies by hydrographic units and subunits as they would occur during a mean year.

3. Ground Water. Ground water constitutes an important source of water supply in many portions of the North Coastal

Hydrographic Area, providing the major source of supply for some sections of the study area, although its availability is relatively less, and its utilization highly localized and relatively smaller than the substantially larger surface water flows.

In some instances, these ground water resources could be further developed to yield additional water to users at a cost which is economically competitive with the least expensive alternative surface water development.

In this investigation, study of ground water consisted primarily of evaluation of existing data which would furnish the following information:

a. Identification of usable ground water basins.

b. Determination of areal extent of these basins.

c. Identification of the predominant geologic characteristics of each basin as they affect the use of stored ground water.

d. Determination of the quantity of usable ground water presently stored in each basin.

e. Estimation of cost of ground water extraction from each basin, based upon prevailing pumping practices and aquifer characteristics.

Future Water Requirements

In the determination of the quantity of water required for use within the study area, it is first necessary to forecast the nature and extent of probable future cultural practices as they affect the use of water.

In this investigation, water requirements were estimated for municipal and industrial uses, irrigated agriculture, recreational purposes, and maintenance of natural fish and wildlife population.

To determine probable future water uses, the department conducted studies of the following types:

1. Municipal and Industrial Water Requirements. These were based upon projections of future population within the study area, and the potential for industrial development, with particular emphases on processing of forest products.

2. Agricultural Applied Water Requirements. Future requirements of farms for irrigation water are based on estimates of the types and amount of agricultural activity which may reasonably be expected within the study area until the year 2020.

The studies of future agricultural applied water requirements are based entirely upon the amounts of irrigated agriculture which are anticipated. In certain areas, however, reservations of land for dry farm practices have been assumed, although they are not specifically mentioned in the tables depicting anticipated future crop areas.

Agricultural activity in the North Coastal Area, as in any other, depends upon ability to obtain a market for its produce. Therefore, the Department of Water Resources has conducted a California market outlook study, which examined California's historic and probable future participation in the national and, to some extent, world market for agricultural products.

The study estimated the amount and kinds of produce California could probably expect to market in competition with other producing areas.

A rough allocation was then made of certain of the crops anticipated in that study, to the North Coastal Hydrographic Area, based upon factors of climate, soil, and market centers. This allocation was interpreted in detail and measured against the climatic and soil conditions of the particular irrigable lands within the study area, to determine the adaptability of these crops.

This crop adaptability, when compared with present land use practices, and related to the probable participation to California in the agricultural market, as indicated in the California market outlook study, provided a basis for detailed projections of future crop patterns within the study area.

These crop patterns, in turn, were then utilized in determining future agricultural applied water requirements for each of the five hydrographic units and their subunits.

3. Recreational Water Requirements. Recreational planning and reservation of ample water for recreational purposes into the foreseeable future are part and parcel of water development planning.

The Davis-Dolwig Act[1/] expresses this principle, and places upon the Department of Water Resources responsibility for including planning for recreation use as a part of general project formulation activities.

1/ Chapter 10 (commencing with Section 11900) of Part 3 of Division 6 of the Water Code.

Accordingly, the department contracted with the Department of Parks and Recreation for preparation of estimates of the amounts of water required for outdoor recreation to the year 2020 in the study area of this report.

These recreational activities include outdoor activities other than those associated with urban development, and include camping, picnicking, fishing, hunting, water sports, and their associated facilities.

In forecasting development of such recreational activities in the North Coastal Hydrographic area, consideration was given to relative attractiveness, distance from population centers, anticipated statewide population growth and anticipated increase in recreational use per capita.

Results of these studies indicated that the study area of this report will experience a vast increase in recreational use and that the many attractions of the area will make it a mecca for vacationers in increasing numbers in the years ahead.

This can be readily understood when the many recreational assets of the area are considered, including the remote and rugged upper reaches of the Eel and Trinity Rivers, the imposing redwood groves, the rivers and beaches of the Russian River area and the stark and inviting coastline of the mighty Pacific Ocean.

4. Fish and Wildlife Water Requirements. The Davis-Dolwig Act provides for full consideration of the water requirements for the preservation and enhancement of fish and wildlife resources and for public recreation in the planning, authorization, and

construction of water resources development projects. The use of water for such purposes is recognized as a beneficial use under provisions of the Water Code governing the appropriation of water.1/

Specifically, Water Code Section 11911 provides:

> "The planning for public recreation use and fish and wildlife preservation and enhancement in connection with state water projects shall be a part of the general project formulation activities of the Department of Water Resources, in consultation and cooperation with the departments and agencies specified in Section 11910..."

Section 11910 states:

> "There shall be incorporated in the planning and construction of each project such features (including, but not limited to, additional storage capacity) as the department, after giving full consideration to any recommendations which may be made by the Department of Fish and Game, the Department of Natural Resources or any division thereof, including but not limited to, the Division of Small Craft Harbors and the Division of Beaches and Parks, any federal agency, and any local governmental agency with jurisdiction over the area involved, determines necessary or desirable for the preservation of fish and wildlife, and necessary or desirable to permit, on a year-round basis, full utilization of the project,for the enhancement of fish and wildlife and for recreational purposes to the extent that such features are consistent with other uses of the project, if any. It is the intent of the Legislature that there shall be full and close coordination of all planning for the preservation and enhancement of fish and wildlife and for recreation in connection with state water projects by and between the Department of Water Resources, the Department of Natural Resources, the Department of Fish and Game and all appropriate federal and local agencies.

Accordingly, the Department of Water Resources contracted with the State Department of Fish and Game to make studies to determine the amounts of water necessary for the preservation and maintenance of the current average fish and wildlife populations in the North Coastal Hydrographic area. These studies, jointly funded by both the North Coastal Area Investigation and the Coordinated

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1/ Chapter 10 (commencing with Section 11900) of Part 3 of Division 6 of the Water Code.

Statewide Planning Program, provide estimates of streamflow requirements at hydrographic subunit boundaries and major potential damsites throughout the entire North Coastal Hydrographic area. This information is being published as Appendix C to Bulletin No. 136. These water requirements for fish and wildlife maintenance are included as a beneficial water requirement in the determination of water surplus and deficiencies in this bulletin.

Water Surplus or Deficiency

There is sufficient water within California, actual precipitation of rain and snow, to meet the needs of all areas, but a maldistribution of the supply exists, both as to time and place. More than 70 percent of the water of California originates in the northern third of the State, while 77 percent of the water need is in the southern two-thirds. In addition, practically all of the precipitation occurs in the winter and spring, and little or none during summer and fall.

Basic to any solution of the problem of maldistribution of water supplies are conservation, and areal and seasonal redistribution. One of the major contributions of the department toward such a solution is its continuing planning activities. In these activities the importance and urgency of needs of the areas in which the water to be redistributed originates has been recognized and emphasized. Plans formulated by the department have formed the basis for a number of locally constructed projects, as well as the

State Water Project now being constructed under authorization of the Burns-Porter Act.[1/]

The department will operate the State Water Project pursuant to the provisions of the Water Code governing the Central Valley Project, including Sections 11460 to 11463, the area of origin law. Those sections provide that in the operation of the project a watershed or area wherein water originates, or an immediately adjacent watershed, shall not be deprived of the prior right to all of the water reasonably required to supply beneficial needs within such watershed or area. In addition, pursuant to the provisions of Water Code Section 10505, the county of origin law, the applications under which the department will appropriate water for the State Water Project are subject to a general reservation for the counties in which the water originates.

In addition to the protection given to areas in which water originates by specific provisions of the Water Code, the Burns-Porter Act authorizes the construction of such additional facilities as the department determines to be necessary and desirable to meet local needs, and to augment the supplies of water in the Sacramento-San Joaquin Delta. To the extent that money is expended from the California Water Fund for construction of the State Water Facilities, the initial features of the State Water Project, proceeds from the sale of bonds authorized by the Burns-Porter Act must

1/ Chapter 8 (commencing with Section 12930) of Part 6 of Division 6 of the Water Code; also cited as the California Water Resources Development Bond Act.

be expended for the construction of such additional facilities in the watersheds of the Sacramento, Eel, Trinity, Mad, Van Duzen, and Klamath Rivers.

Investigations which led to formulation of The California Water Plan[1/] indicated that development and exportation of some of the naturally occurring water in the North Coastal Hydrographic area would be essential to statewide economic growth.

One of the purposes of this investigation is to determine the quantities of water reasonably required for future use in the area of origin to meet local needs and the quantities, if any, available for export.

To make these determinations, estimates of water surpluses and deficiencies in this report were made on a monthly basis for each hydrographic unit and subunit and were based on the 50-year mean monthly natural flows modified by existing controls, structures and diversions.

Definitions

In order that there shall be full understanding of the meaning of certain specialized terms employed in this bulletin, this section presents definitions of these terms.

Applied Water

The water delivered to a farmer's headgate in the case of irrigation use, or to an individual's meter, or its equivalent, in the case of urban use. It does not include direct precipitation.

1/ See Part 1.5 (commencing with Section 10004) of Division 6 of the Water Code.

Water Requirement

The water needed to provide for all beneficial uses and all irrecoverable losses incidental to uses.

Consumptive Use of Water

Water used consumptively is water that is transpired by plants, water that is retained in plant tissue, and water that is evaporated from plant, soil, water, and other surfaces. It similarly refers to water that is transpired or evaporated from urban lands and water expended by other urban-related uses.

Irrigation Efficiency

The ratio of consumptive use of applied irrigation water to the total amount of water applied, expressed as a percentage.

Natural Flow

The flow of a stream as it would be if unaltered by upstream diversion, storage, import, export, or change in upstream consumptive use caused by development.

Impaired Flow

The actual flow of a stream with any given stage of upstream development.

Aquifers

A geologic formation or zone sufficiently permeable to yield water to wells or springs.

Irrigation Water Service Area Efficiency

The ratio of consumptive use of applied irrigation water in a given service area to the gross amount of water delivered to the area, expressed as a percentage.

Free Ground Water

A body of ground water not immediately overlain by impervious materials and moving under control of the water table slope.

Confined Ground Water

A body of ground water immediately overlain by materials sufficiently impervious to sever free hydraulic connection with overlying water, and moving under pressure caused by the difference in head between the intake or forebay area and the discharge area of the confined water body.

Contamination

Impairment of the quality of water by sewage or industrial waste to a degree which creates a hazard to public health through poisoning or spread of disease.

Pollution

Impairment of the quality of water by sewage or industrial waste to a degree which does not create a hazard to public health, but which adversely and unreasonably affects such water for beneficial uses.

Degradation

Impairment of the quality of water to an unspecified degree, due to any cause, either natural or artificial.

CHAPTER II

WATER RESOURCES

Surface Water Hydrology

The portion of the North Coastal area studied in this report has the most abundant natural water supply of any area in the State. While occupying only 7 percent of California in area, it has about 23 percent of the State's entire streamflow.

This chapter discusses the water resources and summarizes streamflow data for each of the hydrographic units and subunits of the study area.

Water problems stemming from the physical features of the units and the seasonal distribution of rainfall are common to all units. Damaging floods and other problems will be discussed in later sections dealing with precipitation and runoff.

Precipitation

The water resources of the study area originate as some form of precipitation. Heavy precipitation occurs in the winter months, with about 90 percent occurring from October through April; however, light precipitation may occur any time during the summer months.

Some precipitation occurs as fog in the low-lying lands near the Pacific Ocean, but the major portion of the precipitation occurs as rain or snow. Precipitation may contribute directly to streamflow as it occurs, or it may be detained temporarily as snowpack or percolate through the soil where it may either be extracted by plants or become ground water. As ground

TABLE 6

MEAN MONTHLY DISTRIBUTION OF PRECIPITATION AT REPRESENTATIVE STATIONS FOR PERIOD 1910-11 TO 1959-60

Month	Station				
	Weaverville Ranger Station	Ukiah	Eureka	Upper Mattole	Santa Rosa
July					
Inches	0.14	0.04	0.11	0.12	0.03
%	.40	0.10	0.30	0.20	0.10
August					
Inches	0.17	0.04	0.12	0.16	0.05
%	.50	0.10	0.30	0.20	0.20
September					
Inches	0.63	0.40	0.79	1.11	0.37
%	1.80	1.00	2.20	1.40	1.30
October					
Inches	2.18	1.78	2.66	5.03	1.38
%	6.20	5.10	7.30	6.60	4.80
November					
Inches	4.65	3.85	4.64	10.31	3.15
%	13.30	11.10	12.70	13.40	10.90
December					
Inches	6.31	7.02	6.18	14.06	5.51
%	18.00	20.10	17.00	18.30	19.20
January					
Inches	6.81	7.40	6.48	14.96	5.95
%	19.40	21.20	17.80	19.50	20.70
February					
Inches	5.76	6.44	5.47	12.70	5.22
%	16.40	18.50	15.00	16.60	18.20
March					
Inches	3.73	4.03	4.57	9.01	3.55
%	10.60	11.60	12.50	11.80	12.40
April					
Inches	2.48	2.39	2.84	5.44	2.22
%	7.10	6.90	7.80	7.10	7.70
May					
Inches	1.38	1.07	1.83	2.82	1.00
%	4.00	3.10	5.00	3.70	3.50
June					
Inches	0.82	0.41	0.74	0.94	0.30
%	2.30	1.20	2.10	1.20	1.00
Total					
(inches)	35.06	34.87	36.43	76.66	28.73
(%)	100.00	100.00	100.00	100.00	100.00

water it may remain in the area as ground water storage, may be pumped for use, or may emerge as streamflow.

A summary of mean monthly precipitation at five representative locations is shown in Table 6. Precipitation in each hydrographic unit is discussed in more detail later in this chapter. An isohyetal map of the study area is presented on Plate 2.

Runoff

Mean annual runoff for the study area is about 18,100,000 acre-feet, 90 percent of which occurs during the six-month period December through May. The runoff pattern is similar to the precipitation pattern except that snowpack and percolation cause a major portion of the runoff to occur from one to two months after the major portion of precipitation occurs.

A more detailed discussion of runoff, tables of annual and monthly streamflows at selected gaging stations, and a table of mean monthly distribution of streamflows for each hydrographic unit and subunit is presented later in this chapter.

Water Development

Present water development is discussed later in this chapter for each hydrographic unit.

Streamflow Estimates

Estimates of monthly and annual full natural flows for the 50-year period from 1910-11 through 1959-60 were, with two exceptions, compiled for all gaging stations within the study area for which five or more years of record were available. A brief description of the methods used to make these estimates for individual gaging stations is included with the tabulations of streamflow. Detailed data on correlations used, other correlations attempted, adjustment factors, etc., are available in the files of the North Coastal Area Investigation. In some stream basins where consumptive use of artificially applied water was considered to be significant, a correction factor was applied to the streamflows, but in areas of little development, no correction was applied and the measured streamflow was used as the full natural flow. The records to which corrections were applied are noted in the station descriptions in the tables of streamflow.

Estimates of streamflow for each hydrographic unit are presented later in this chapter.

Stream Gaging Stations

There are approximately 40 stream gaging stations in the study area; however, only 3 were in continuous operation during the entire 50-year period 1910-60. In general, gaging stations with records of 5 years or more, but less than 50 years, were correlated with stations having records of 50 years. This method is considered adequate to estimate the streamflow in the area. A discussion and list of stream gaging stations in each hydrographic unit is presented later in this chapter.

The location of stream gaging stations used in preparing this report are shown on Plate 1.

Flow Duration Curves

Flow duration curves showing the number of days within each year and within the period of record that a given flow was equalled or exceeded were prepared for 20 major gaging stations in the study area. These curves were plotted from data presented in the U. S. Geological Survey open file report, "Flow Duration and High- and Low-Flow Tables for California Streams," December 1961.

The gaging station on the Trinity River at Lewiston was used as an index station for four other gaging stations in the Trinity River Hydrographic Unit. The curves for these four stations were adjusted to represent the same period as the index station (water years 1910-60).

The gaging station on the Eel River at Scotia was used as an index station for four other stations in the Eel River Hydrographic Unit and two stations in the Mad River-Redwood Creek Hydrographic Unit. The curves of these six stations were adjusted to represent the same period as the index station (water years 1911-14 and 1917-60).

The gaging station on the Russian River near Healdsburg was used as an index station for four other gaging stations in the Russian River Hydrographic Unit and three gaging stations in the Mendocino Coast Hydrographic Unit. The curves for these seven stations were adjusted to represent the same period as the index station (water years 1940-57).

These curves are shown on Figures 4 through 8.

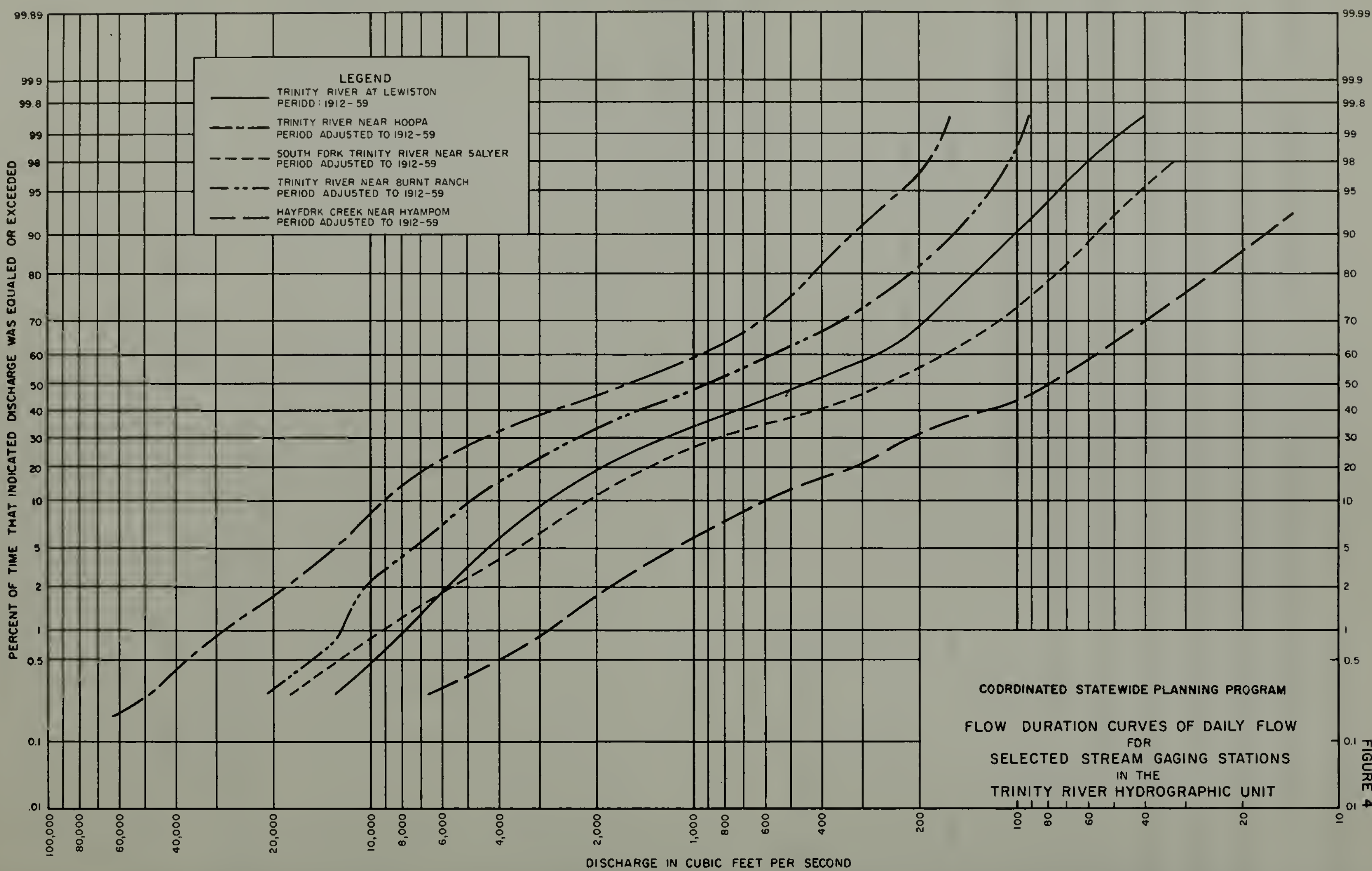
LEGEND
TRINITY RIVER AT LEWISTON
PERIOD: 1912-59
TRINITY RIVER NEAR HOOPA
PERIOD ADJUSTED TO 1912-59
SOUTH FORK TRINITY RIVER NEAR SALYER
PERIOD ADJUSTED TO 1912-59
TRINITY RIVER NEAR BURNT RANCH
PERIOD ADJUSTED TO 1912-59
HAYFORK CREEK NEAR HYAMPOM
PERIOD ADJUSTED TO 1912-59
PERCENT OF TIME THAT INDICATED DISCHARGE WAS EQUALED OR EXCEEDED
DISCHARGE IN CUBIC FEET PER SECOND
COORDINATED STATEWIDE PLANNING PROGRAM
FLOW DURATION CURVES OF DAILY FLOW
FOR
SELECTED STREAM GAGING STATIONS
IN THE
TRINITY RIVER HYDROGRAPHIC UNIT

FIGURE 4

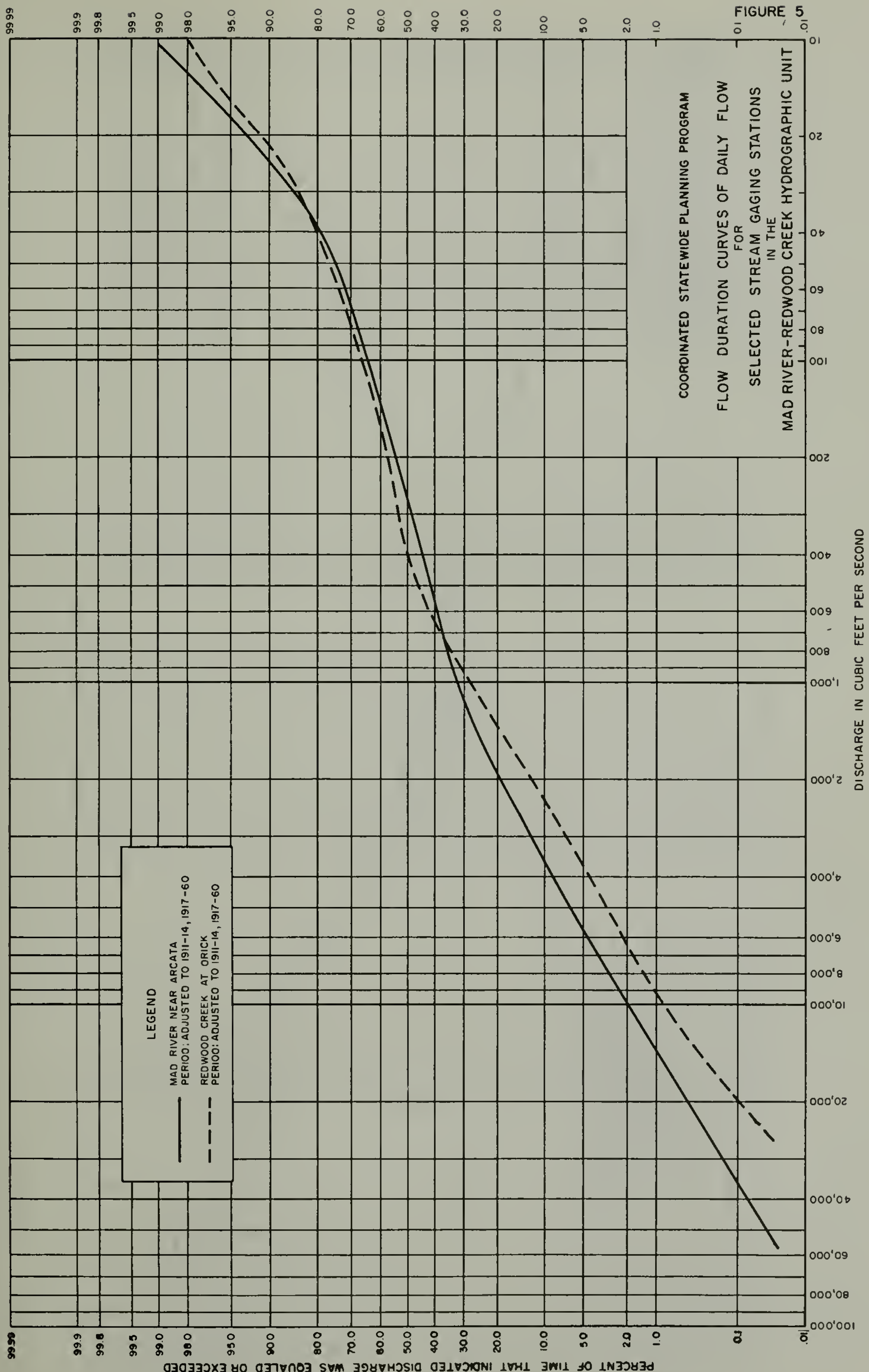

FIGURE 5
COORDINATED STATEWIDE PLANNING PROGRAM
FLOW DURATION CURVES OF DAILY FLOW
FOR
SELECTED STREAM GAGING STATIONS
IN THE
MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT
LEGEND
MAD RIVER NEAR ARCATA
PERIOD: ADJUSTED TO 1911-14, 1917-60
REDWOOD CREEK AT ORICK
PERIOD: ADJUSTED TO 1911-14, 1917-60
PERCENT OF TIME THAT INDICATED DISCHARGE WAS EQUALED OR EXCEEDED
DISCHARGE IN CUBIC FEET PER SECOND
99.99
99.9
99.8
99.5
99.0
98.0
95.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
5.0
2.0
1.0
0.1
.01
10
20
40
60
80
100
200
400
600
800
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6,000
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40,000
60,000
80,000
100,000

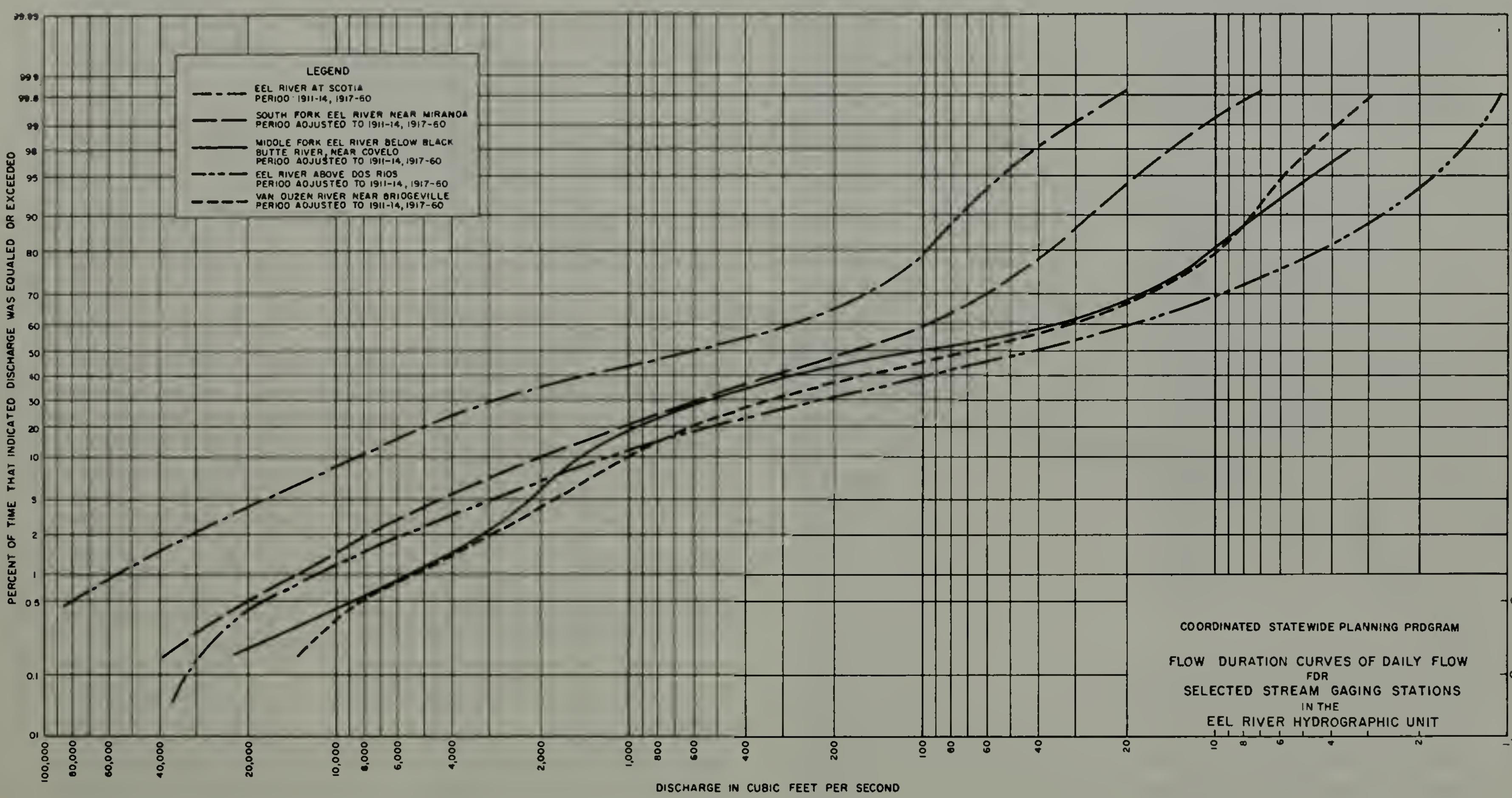

LEGEND
EEL RIVER AT SCOTIA
PERIOD 1911-14, 1917-60
SOUTH FORK EEL RIVER NEAR MIRANDA
PERIOD ADJUSTED TO 1911-14, 1917-60
MIDDLE FORK EEL RIVER BELOW BLACK BUTTE RIVER, NEAR COVELO
PERIOD ADJUSTED TO 1911-14, 1917-60
EEL RIVER ABOVE DOS RIOS
PERIOD ADJUSTED TO 1911-14, 1917-60
VAN DUZEN RIVER NEAR BRIDGEVILLE
PERIOD ADJUSTED TO 1911-14, 1917-60
PERCENT OF TIME THAT INDICATED DISCHARGE WAS EQUALED OR EXCEEDED
DISCHARGE IN CUBIC FEET PER SECOND
COORDINATED STATEWIDE PLANNING PROGRAM
FLOW DURATION CURVES OF DAILY FLOW
FOR
SELECTED STREAM GAGING STATIONS
IN THE
EEL RIVER HYDROGRAPHIC UNIT

FIGURE 6

FIGURE 7

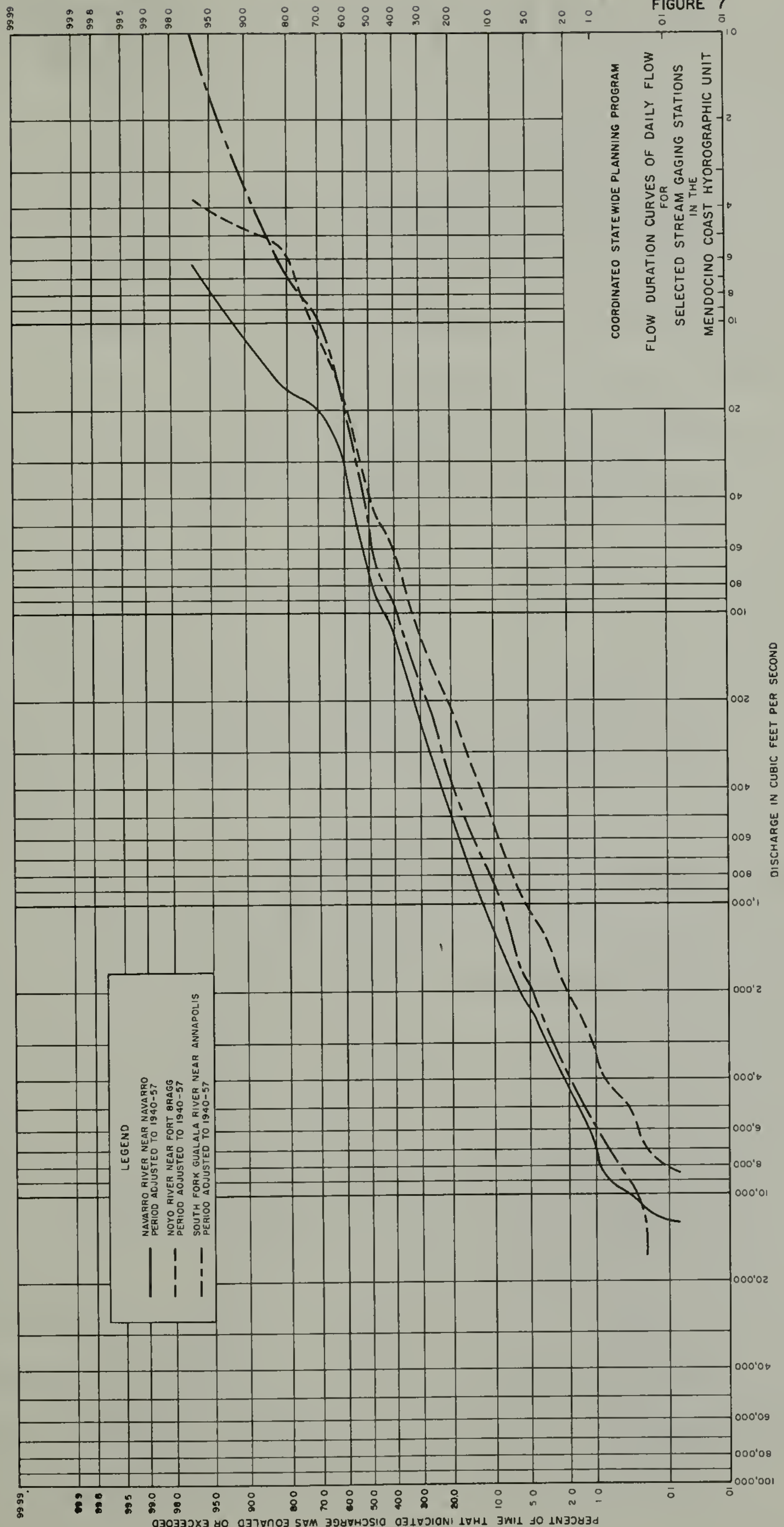
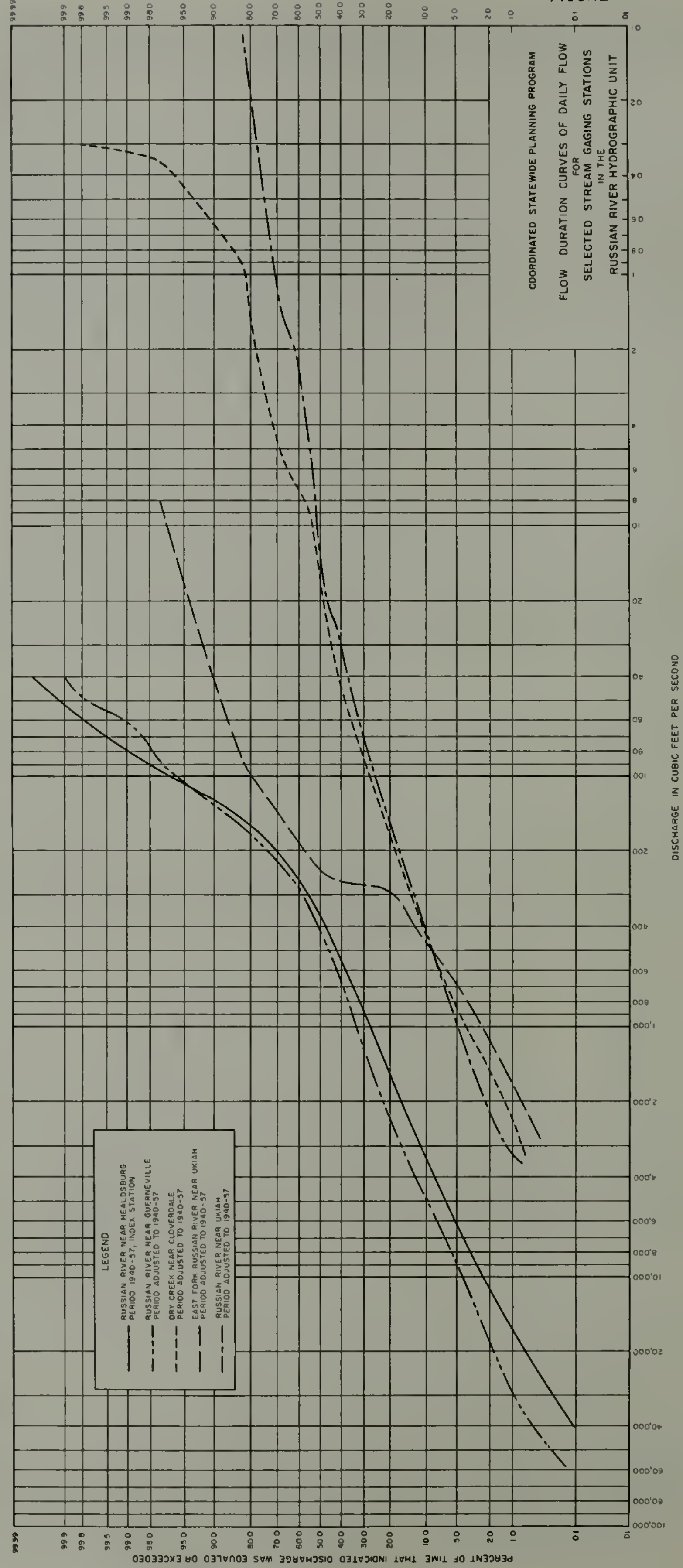

COORDINATED STATEWIDE PLANNING PROGRAM
FLOW DURATION CURVES OF DAILY FLOW
FOR
SELECTED STREAM GAGING STATIONS
IN THE
MENDOCINO COAST HYDROGRAPHIC UNIT
LEGEND
NAVARRO RIVER NEAR NAVARRO
PERIOD ADJUSTED TO 1940-57
NOYO RIVER NEAR FORT BRAGG
PERIOD ADJUSTED TO 1940-57
SOUTH FORK GUALALA RIVER NEAR ANNAPOLIS
PERIOD ADJUSTED TO 1940-57
DISCHARGE IN CUBIC FEET PER SECOND
PERCENT OF TIME THAT INDICATED DISCHARGE WAS EQUALED OR EXCEEDED

FIGURE 8



COORDINATED STATEWIDE PLANNING PROGRAM
FLOW DURATION CURVES OF DAILY FLOW
FOR
SELECTED STREAM GAGING STATIONS
IN THE
RUSSIAN RIVER HYDROGRAPHIC UNIT
LEGEND
RUSSIAN RIVER NEAR HEALDSBURG
PERIOD 1940-57, INDEX STATION
RUSSIAN RIVER NEAR GUERNEVILLE
PERIOD ADJUSTED TO 1940-57
DRY CREEK NEAR CLOVERDALE
PERIOD ADJUSTED TO 1940-57
EAST FORK RUSSIAN RIVER NEAR UKIAH
PERIOD ADJUSTED TO 1940-57
RUSSIAN RIVER NEAR UKIAH
PERIOD ADJUSTED TO 1940-57
DISCHARGE IN CUBIC FEET PER SECOND
PERCENT OF TIME THAT INDICATED DISCHARGE WAS EQUALED OR EXCEEDED

Flood Frequency Curves

Flood frequency curves for the study area were prepared by using the U. S. Geological Survey's manual "Flood Frequency Analysis," Water Supply Paper 1543-A, 1960 edition. These curves show recurrence intervals of probabilities of specific floods. This does not imply that floods will occur at constant intervals of time. For example, a 100-year flood will probably not occur every 100 years, but there is a one percent chance it will occur in any one year. This publication expresses the magnitude of floods of different frequencies as ratios to the mean annual flood. A mean annual flood may be defined as the value of the frequency curve at a recurrence interval of 2.33 years. The 2.33 year flood is used because it can be demonstrated by use of the theory of extreme values that the mean of many annual flood peaks has a magnitude equivalent to the flood having a recurrence interval of 2.33 years.

Regional flood frequency curves for the North Coastal area were abstracted from a study dated June 1960, which was made by the hydrology unit for the North Coastal Area Investigation. This study established the homogeneity of floods within the North Coast area, including the Trinity River, Eel River, and Mad River-Redwood Creek Hydrographic Units and developed a regional flood frequency analysis for this area. The mean annual floods for the gaging station on the Mad River near Forest Glen and for streams in the Russian River and Mendocino Coast Hydrographic Units were not determined in the above study, but were determined by the same method. The mean annual floods for the gaging stations on

Redwood Creek were estimated by a method of proportioning the available period of record over the long-term base period, and are considered to be good approximations of the true mean annual floods.

Tables of mean annual floods for the gaging stations within each hydrographic unit together with the flood frequency curves for that unit may be used to estimate a maximum flood flow at any one of the stations for any desired recurrence interval. To estimate a maximum flood flow enter the flood frequency curve at the desired recurrence interval to obtain a median ratio for the desired flood. This ratio times the proper mean annual flood gives the estimated maximum flood for the recurrence interval. For example, the maximum 2-day flood volume for a 100-year recurrence interval at the gage S.F. Eel River near Branscomb would be estimated as 2.75 times 6,100 cfs-days or 16,800 cfs-days.

Mean annual floods are presented on Tables 7 through 9 with flood frequency curves on Figures 9 through 11.

Iso-Runoff Map

An iso-runoff map of the study area showing generalized lines of equal mean seasonal runoff in inches for a 50-year base period from 1910-11 through 1959-60 is presented on Plate 1. It pictures runoff production on a point-by-point basis, and is directly comparable to an isohyetal map. This map is based principally on the gaging station full natural flows and the mean precipitation, with secondary consideration being given to the influence of topography, geology, and vegetative ground cover.

TABLE 7

MEAN ANNUAL FLOODS FOR THE NORTH COASTAL AREA[1/]

Station	Drainage Area (square miles)	Mean Annual Floods: Instantaneous (cfs)	1-Day (cfs-days)	2-Day (cfs-days)	3-Day (cfs-days)	5-Day (cfs-days)
				Trinity River Hydrographic Unit		
Trinity River at Lewiston	726	19,000	14,700	26,500	34,500	46,000
Trinity River nr Douglas City	1,017	20,500	18,500	33,500	43,500	57,500
N.F. Trinity River at Helena	151	9,000	6,200	9,600	12,400	-0-
Trinity River nr Burnt Ranch	1,438	32,000	25,400	46,000	57,000	75,000
S.F. Trinity River nr Hyampom	342	14,400	10,800	19,000	25,000	-0-
Hayfork Creek nr Hyampom	379	10,800	7,300	13,700	16,200	-0-
S.F. Trinity River nr Salyer	899	25,000	21,000	36,000	43,000	60,000
Trinity River nr Hoopa	2,848	59,000	51,000	92,000	125,000	170,000
				Mad River-Redwood Creek Hydrographic Unit		
Mad River nr Arcata	485	26,500	22,000	36,000	48,000	64,000
Mad River nr Forest Glen	144	8,600	6,200	10,000	12,600	-0-
Redwood Creek at Orick	278	25,500	18,300	31,000	40,000	-0-
Redwood Creek nr Blue Lake	68	9,000	5,500	8,000	10,000	-0-
				Eel River Hydrographic Unit		
Eel River below Scott Dam	290	17,200	11,100	18,300	22,500	29,900
Eel River at Van Arsdale Dam	349	17,600	13,700	21,200	26,500	34,500
Eel River above Dos Rios	705	31,800	27,500	49,100	62,000	75,000
M.F. Eel River below Black Butte River	367	24,800	18,200	28,000	36,000	48,000
Eel River below Dos Rios	1,484	72,000	58,000	95,000	130,000	175,000
N.F. Eel River nr Mina	250	17,100	12,200	21,000	26,200	32,600
S.F. Eel River nr Branscomb	44	5,000	3,200	6,100	7,000	9,500
S.F. Eel River nr Miranda	537	42,200	33,400	59,500	73,500	91,500
Eel River at Scotia	3,113	161,000	132,000	240,000	301,000	404,000
Van Duzen River nr Bridgeville	216	20,000	14,900	25,000	34,200	46,400

1/ The Regional Annual Flood Volume-Frequency Curves for the North Coastal area include the Smith River and the Lower Klamath River (Excluding Shasta-Scott) Basins. However, mean annual floods for the Smith and Lower Klamath Rivers are not presented as they are not part of the study area.

TABLE 8

MEAN ANNUAL FLOODS FOR THE MENDOCINO COAST HYDROGRAPHIC UNIT

Station	Drainage Area (square miles)	Mean Annual Floods			
		Instantaneous (cfs)	1-Day (cfs-days)	2-Day (cfs-days)	3-Day (cfs-days)
Navarro River nr Navarro	304	25,000	19,500	28,000	34,500
Noyo River nr Fort Bragg	105	10,800	7,400	11,300	13,700
S.F. Gualala River nr Annapolis	161	32,000	14,500	20,800	44,000

TABLE 9

MEAN ANNUAL FLOODS FOR THE RUSSIAN RIVER HYDROGRAPHIC UNIT

Station	Drainage Area (square miles)	Mean Annual Floods			
		Instantaneous (cfs)	1-Day (cfs-days)	2-Day (cfs-days)	3-Day (cfs-days)
E.F. Russian River nr Ukiah	105	5,600	3,300	4,950	6,000
Russian River nr Ukiah	100	10,300	5,200	8,300	9,600
Dry Creek nr Cloverdale	88	11,100	5,500	8,900	10,700
Russian River nr Healdsburg	791	36,700	32,400	53,900	70,800
Russian River nr Guerneville	1,342	53,200	47,900	90,000	113,500

FIGURE 9

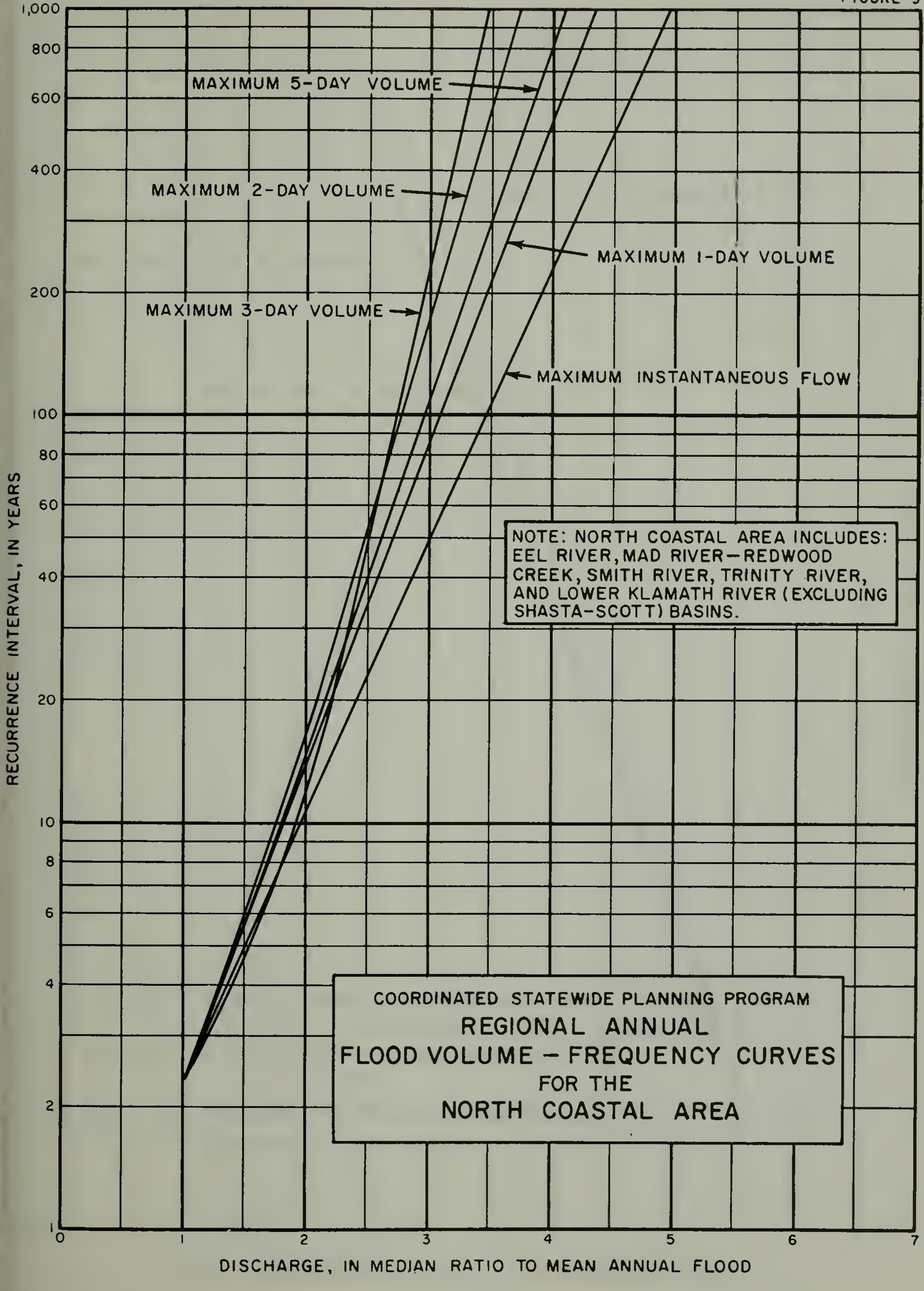

1,000
800
600
400
200
100
80
60
40
20
10
8
6
4
2
1
RECURRENCE INTERVAL, IN YEARS
MAXIMUM 5-DAY VOLUME
MAXIMUM 2-DAY VOLUME
MAXIMUM 1-DAY VOLUME
MAXIMUM 3-DAY VOLUME
MAXIMUM INSTANTANEOUS FLOW
NOTE: NORTH COASTAL AREA INCLUDES: EEL RIVER, MAD RIVER—REDWOOD CREEK, SMITH RIVER, TRINITY RIVER, AND LOWER KLAMATH RIVER (EXCLUDING SHASTA-SCOTT) BASINS.
COORDINATED STATEWIDE PLANNING PROGRAM
REGIONAL ANNUAL
FLOOD VOLUME — FREQUENCY CURVES
FOR THE
NORTH COASTAL AREA
0
1
2
3
4
5
6
7
DISCHARGE, IN MEDIAN RATIO TO MEAN ANNUAL FLOOD

FIGURE 10

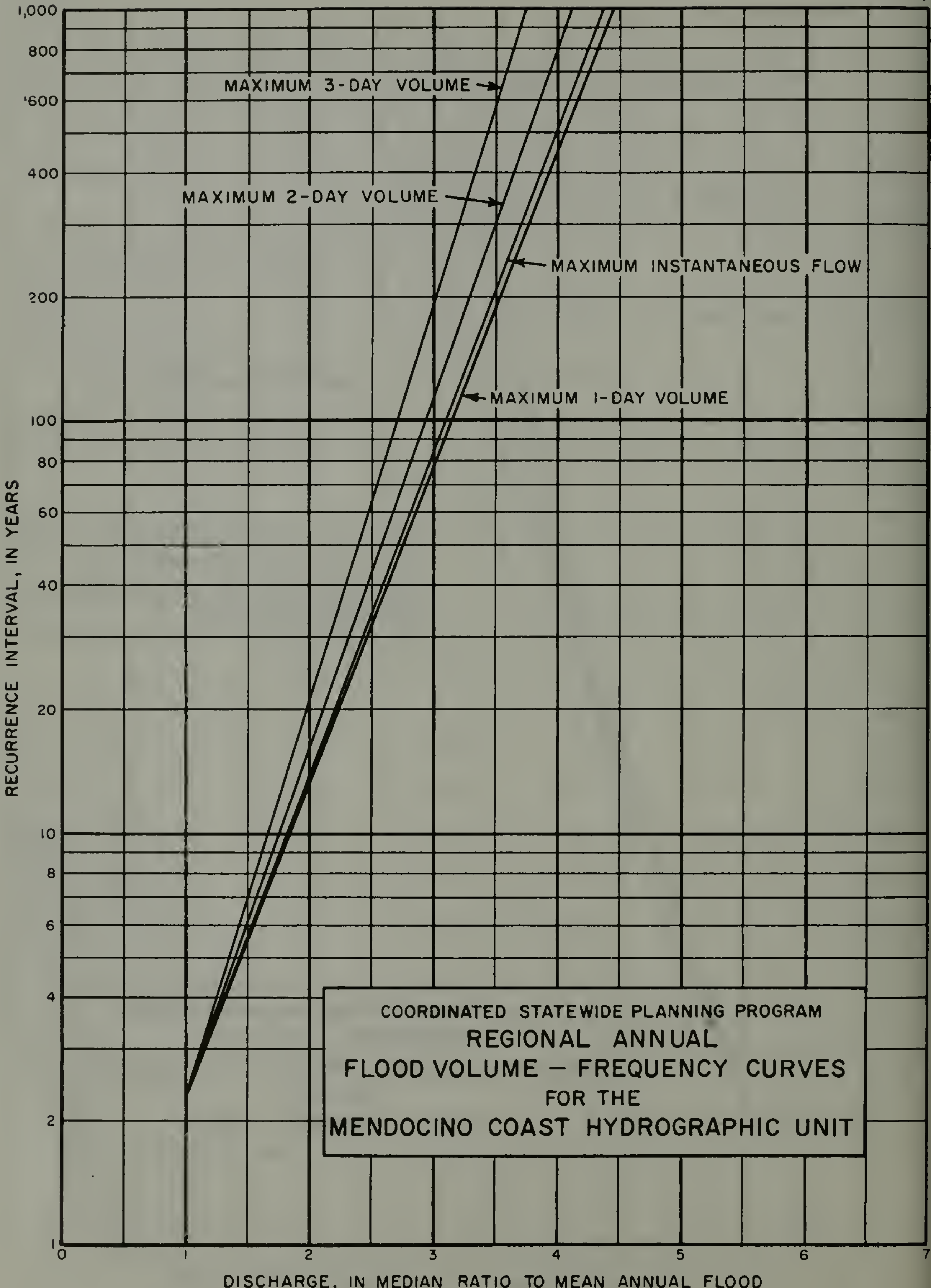
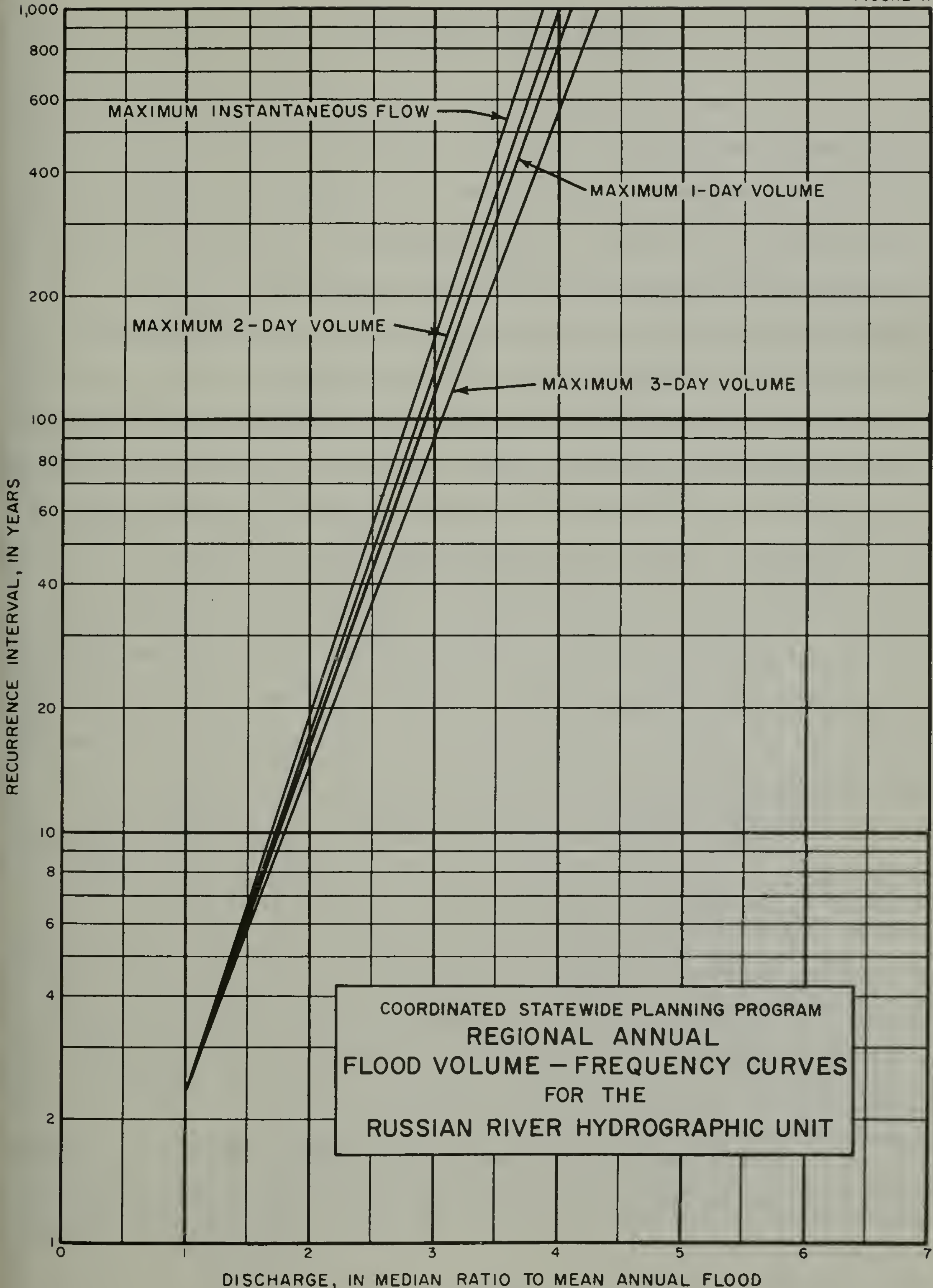

MAXIMUM 3-DAY VOLUME
MAXIMUM 2-DAY VOLUME
MAXIMUM INSTANTANEOUS FLOW
MAXIMUM 1-DAY VOLUME
RECURRENCE INTERVAL, IN YEARS
DISCHARGE, IN MEDIAN RATIO TO MEAN ANNUAL FLOOD
1,000
800
600
400
200
100
80
60
40
20
10
8
6
4
2
1
0
1
2
3
4
5
6
7
COORDINATED STATEWIDE PLANNING PROGRAM
REGIONAL ANNUAL
FLOOD VOLUME – FREQUENCY CURVES
FOR THE
MENDOCINO COAST HYDROGRAPHIC UNIT

FIGURE 11



COORDINATED STATEWIDE PLANNING PROGRAM
REGIONAL ANNUAL
FLOOD VOLUME – FREQUENCY CURVES
FOR THE
RUSSIAN RIVER HYDROGRAPHIC UNIT

Ground Water Hydrology

This section presents generalized information concerning ground water conditions within the study area. It was prepared as part of the long-range objective of the Coordinated Statewide Planning Program to determine the availability of all water resources of the area. This ground water information will provide a basis for continuing reappraisal of each basin, and for determining which basins may need additional ground water studies.

The geologic and ground water investigation included all areas where water-bearing materials occurred in quantities sufficient to constitute a recoverable and usable source of supply throughout the study area. Fourteen principal ground water basins are described with reference to geologic features, ground water occurrence and movement, recharge potential, water quality, usable storage capacity, and ground water pumping costs. Several other small areas, not all defined as ground water basins, are also mentioned and discussed in less detail. Locations of all areas described are shown on Plate 3.

The basins of the study area, with the exception of those in the Russian River Hydrographic Unit, have not been developed as extensively as basins elsewhere in the State. Ground water is used in varying degrees throughout the study area for agricultural, domestic, industrial, stock, and urban purposes; however, in only a few basins is ground water used more extensively for irrigation than surface water.

Objectives of the ground water study were to: (1) define the ground water basins; (2) determine the extent and thickness of water-bearing materials; (3) estimate yield and ground water reservoir capacity of these materials; and (4) collect sufficient well data for determination of ground water pumping costs.

Data from existing reports were used, and additional data were obtained where needed. References used in connection with this study are listed in the bibliography at the end of this report.

Usable storage capacities were determined by re-evaluating many of the same water well logs used in previous studies, and where additional data were available, the well logs were used to make refinements in the storage computations. In general, the procedure outlined in the U. S. Geological Survey Water Supply Paper 1469 for tabulating specific yields was used.

In these studies, present economics were not considered a factor in computing usable storage capacities and, therefore, the only limitations were water quality and low permeability (or low specific yield). The definition of usable ground water storage capacity for this study is as follows:

> Usable storage is that capacity that can be shown to be capable of being dewatered and capable of being resaturated within a reasonable length of time and which contains water of satisfactory quality.

Throughout most of the North Coastal ground water basins, water quality was not a limiting factor except for some of the coastal basins where usable storage is limited by the possibility of sea-water intrusion. Materials of low permeability and materials of poor yielding ability were the most important factors limiting usable storage. Such materials as clay and shale, which are conventionally assigned a specific yield of 3 percent, were excluded from the storage capacity computations.

Pumping costs were determined on the basis of characteristics of existing wells for each basin or area. In some cases, costs were based on the most typical well performance characteristics, depths, and pump sizes, and in other cases, average characteristics were used. Annual costs were computed in dollars-per-acre-foot for varying conditions of use and pumping lifts. The costs are based on present prices (1961) and include the cost of the well and pumping equipment, depreciation of these costs over a 20-year period, interest on the investment at 5 percent, maintenance and repairs on the well and equipment at a rate of 4 percent and the energy cost. The cost is for the water at the well site and does not include distribution, but it does include the cost of providing a pressure of 55 pounds per square inch required for operation of irrigation sprinkler systems. It should be emphasized that the costs only indicate the general order of magnitude because of the large number of variable factors involved. Actual costs can only be determined by knowing specific operating conditions for a particular installation.

Numerous studies and investigations pertaining to geology and ground water have been made in the North Coastal area. Prominent among these are studies by the U. S. Geological Survey and the U. S. Bureau of Reclamation. The U. S. Geological Survey, Mineral Deposits Branch, conducted reconnaissance investigations of the entire area during the early 1950's. Specific studies on certain of the ground water basins were conducted by the Ground Water Branch of the U. S. Geological Survey in cooperation with the Department of Water Resources during the period 1951-55. The

U. S. Bureau of Reclamation also conducted ground water studies on a reconnaissance scale. Reports on all these investigations have been published or are otherwise available for public inspection as open file reports.

Regional Geology and Occurrence of Ground Water

The North Coastal area is predominantly a mountainous region comprising parts of two physiographic provinces -- the Northern Coast Range and the Klamath Mountains. In most of the Klamath and North Coastal Range provinces the ground water basins are located in structural depressions formed by faulting and folding and along coastal plains. The structural depressions are partially filled with stream- and lake-deposited sedimentary materials.

The intervening mountainous areas are underlain by consolidated rocks which do not contain usable quantities of ground water. In these rocks, ground water occurs in weathered zones, faults, and joints and in talus and landslide debris. Occasionally, wells are drilled into these rocks and in some places high yields are obtained, but usually yields are barely sufficient for local domestic use.

Water Quality

In order to identify existing or potential problems of water quality in the study area, the inorganic mineral character of the surface and ground water was studied utilizing data which has been collected over periods as long as 12 years.

Results of the findings are discussed for each hydrographic unit, and the rationale and methods employed in these evaluations are given in this section.

Mineral Characterization

There exists naturally on earth a vast number of different mineral compounds which come into contact with ground and surface waters. Water is a nearly universal solvent, able to dissolve, to varying degrees, practically all minerals which it contacts. When dissolved, these usually complex mineral compounds dissociate into fundamental components called ions.

There are several hundred inorganic ions which might possibly be found in a water sample. However, most of these ions, if at all present, exist in such small concentrations that they are undetectable. Therefore, a chemical analysis for approximately 20 most common inorganic ions in a water sample usually is a sufficient measure of its inorganic mineral composition. Upon evaluation of a collection of mineral analyses of water from the study area, it was found that only a few ionic constituents appear in sufficiently large or variable concentrations to warrant their being reported in the characterization of the waters in the area. In this water quality study, it was determined that both ground and surface waters could be characterized adequately by describing their mineral composition in terms of a classification by predominant types of ions in solution, followed by an expression of the concentration of significant dissolved minerals.

When minerals are dissociated into ions, half of them bear positive electrical charges and are called cations, while the other half are negative ions, called anions. Waters were classified with respect to the predominant positive and negative ions. In natural waters, the most prevalent ions of the cation group are calcium, magnesium, and sodium; and the most prevalent anions are bicarbonate, sulfate, and chloride. A classification takes the name of an ion when its concentration constitutes at least half of the total of its ionic group. When no single ion fulfills the requirement, a hyphenated combination of the two most abundant ions is used. Thus, a calcium bicarbonate type of water denotes that calcium constitutes at least half of the concentration of cations and bicarbonate at least half of the concentration of anions. Where calcium, though predominant, might be less than half of the total concentration of cations, and sodium might be next in abundance, the water would be classified as a calcium-sodium bicarbonate type. However, this classification system will not describe the extent to which a water is mineralized or, in other words, express the concentration of significant dissolved minerals.

In this study, a measure of the significant dissolved minerals in a water supply was expressed by reporting the concentrations of boron, and that combination of minerals called "hardness" in terms of parts (by weight) of constituent per million parts (by weight) of water. This term is abbreviated to parts per million (ppm). In addition, the electrical conductivity of the water, measured in micromhos, was reported as an index to the extent of its total mineralization. This index is sufficiently exact to permit an appraisal of the quality of a water with regard to its total dissolved mineral concentration.

Water Quality Problems

Water quality problems in the study area were identified by comparing the existing mineral character of ground and surface water supplies with appropriate water quality criteria. In addition, potential water quality problems posed by sources of mineral degradation were identified and appraised by direct observation, or by indirect measurement of the mineral characteristics of unmeasured accretions.

There are numerous criteria available with which to appraise the quality of water for various beneficial uses. Some of these criteria are extremely detailed, provided that the exact type and conditions of intended water use are specified. However, when considering only general categories of type and conditions of intended use, the appropriate criteria become much less detailed, and an ample degree of judgment must be exercised in concluding a single valued appraisal of water quality. The scope of this water quality study, being broad in area, but limited in detail, required the use of considerable judgment in appraising the quality of a water with the relatively indefinite criteria available.

One of the most important judgmental factors was estimating the extent to which reasonable treatment might lessen a water's undesirable mineral characteristic so as to render it suitable for a use for which it would be unsuitable naturally. The result of exercising such judgment is that waters containing certain undesirable minerals can be described as being of acceptable quality, providing that reasonable treatment could be expected to make it so.

The general mineral character and quality of ground and surface waters of the study area are presented in each of the following discussions of hydrographic units. In these following discussions, a table presents the present mineral character of water by each of the subunits of the hydrographic unit. Significant existing or potential water quality problems in a hydrographic unit are discussed individually. The general quality of water for an entire hydrographic unit is described in terms which are related to average dissolved mineral concentrations as shown in Table 10.

TABLE 10

DESCRIPTIONS OF WATER QUALITY CHARACTERISTICS

Characteristic	Description		
	Low	Moderate	High
Total mineralization (electrical conductivity - micromhos)	Less than 500	500 to 1,000	More than 1,000
Boron - ppm	Less than 0.2	0.2 to 0.5	More than 0.5
	Soft	Moderately hard	Hard
Hardness - ppm	Less than 100	100 to 200	More than 200

In general, water supplies throughout the study area were found to be of a mineral character which is well suited for beneficial use. Surface waters, especially, were found to be of excellent mineral quality. These waters at present are notably free from both natural or man-made degradation. However, some localized conditions exist which create immediate water quality problems or pose potential problems.

TRINITY RIVER HYDROGRAPHIC UNIT

Surface Water Hydrology

General Description of Unit

The Trinity River Hydrographic Unit possesses an abundant supply of water. The most serious water problem in the unit is the periodic occurrence of damaging floods. From the records of the gaging station near Hoopa, six major floods have occurred since 1931. These were observed in 1937, 1940, 1945, 1955, 1958, and 1960. Flood damage, as compared to that in other areas of Northern California, is relatively low due to the limited development in the narrow canyons of the Trinity River watershed.

In contrast to the problem of excess water during the winter rainy season, the unit also has the problem of inadequate streamflow during the summer months to sustain the potential ultimate development of fishery and recreational resources. This problem has been alleviated to some extent on the mainstem of the Trinity River by the construction of Trinity Dam in 1960 and Lewiston Dam in 1962. Trinity Dam also provides some control of winter floods. All other streams in the unit are at present uncontrolled.

Precipitation

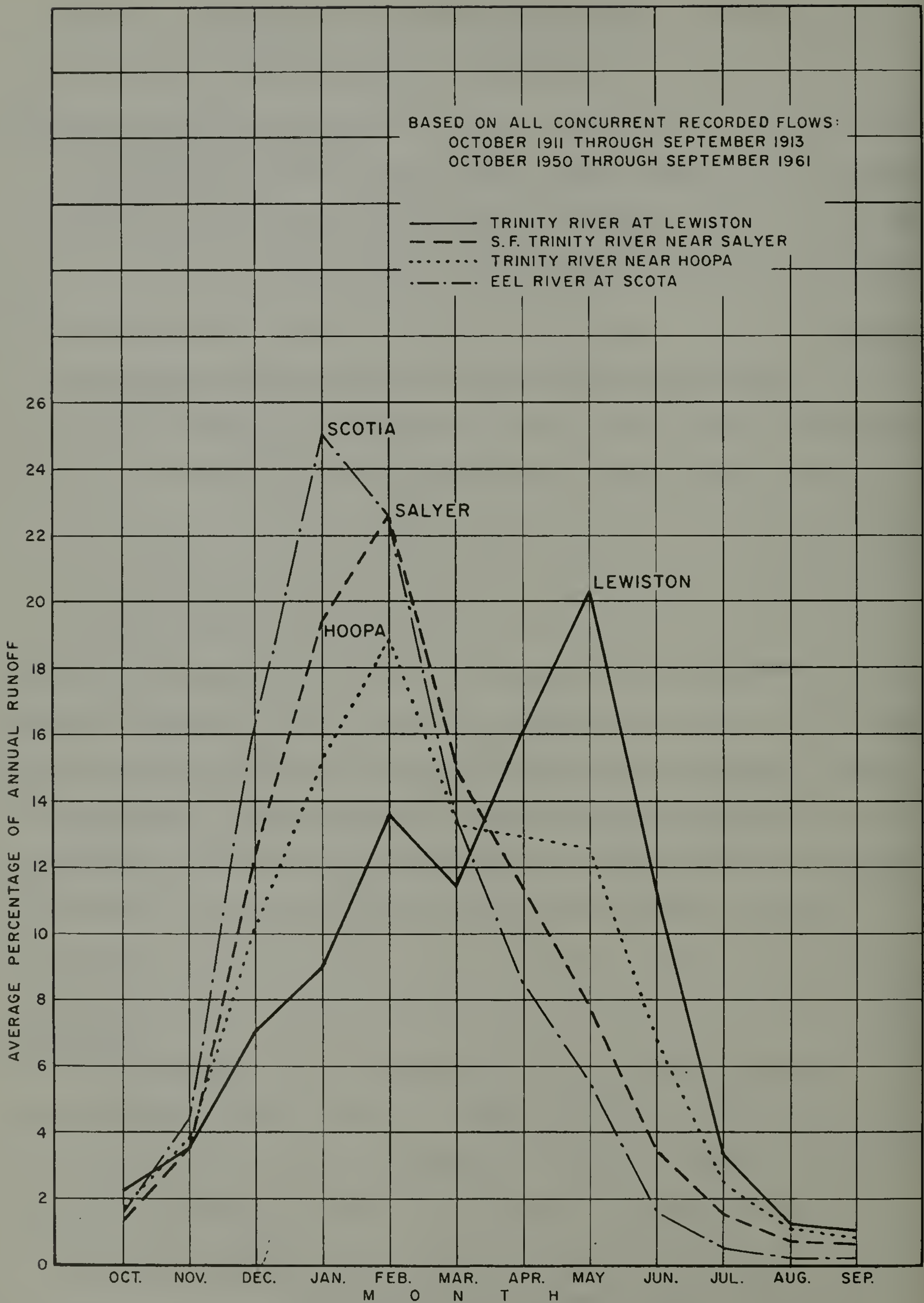
Precipitation in the Trinity River Hydrographic Unit averages about 55 inches annually, occuring mostly in the form of low intensity winter and spring rains or snows. In the southern and western parts of the unit, elevations are generally below 5,000 feet, and precipitation occurs mostly as rain. Elevations in the northern part of the unit are generally above 5,000 feet, and precipitation here occurs mainly as snow. Precipitation within the unit is subject to considerable variation, both annually and geographically. For example, historical annual precipitation at Weaverville has ranged from 17.92 to 67.04 inches; at Hayfork from 13.53 to 54.39 inches; at Forest Glen from 36.59 to 102.46 inches; and at Salyer from 31.22 to 73.20 inches.

Runoff

Mean annual runoff from the Trinity River Hydrographic Unit is about 4,171,000 acre-feet, which is equivalent to a depth of about 26.4 inches over the 2,969 square mile area of the unit. Topographically, the unit is characterized by steep ridges and narrow valleys. The valleys are almost completely barren of alluvial fill which could act as a natural regulating reservoir. Due to the topography and geology of the unit, streamflow in the Middle Trinity, Lower South Fork, Willow Creek, and Hoopa subunits is highly responsive to rainfall, and the pattern of runoff closely follows the seasonal distribution of precipitation. Typically, runoff from these subunits reaches a peak in January or February. In the remaining subunits a large percentage of the precipitation occurs as snow, thereby delaying peak surface runoff until April or May. This relationship is illustrated by the curves shown on Figure 12, which shows the distribution of mean seasonal snowmelt runoff at Lewiston, rainfall runoff at Salyer, and a combination of rainfall and snowmelt runoff at Hoopa.

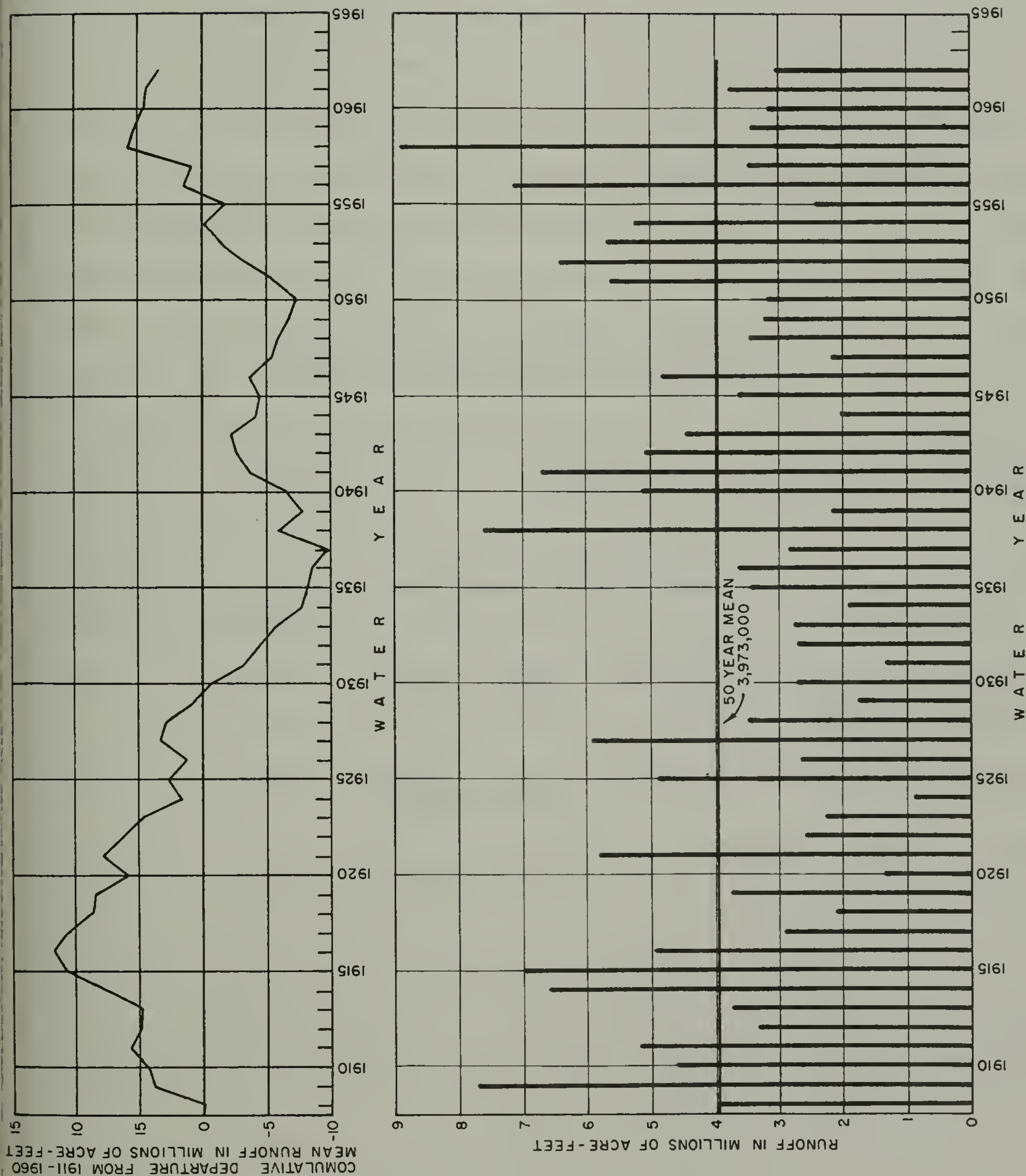
The variation of runoff from season to season is illustrated by the bar chart on Figure 13 which presents the natural seasonal runoff of the Trinity River near Hoopa.

FIGURE 12



AVERAGE MONTHLY DISTRIBUTION OF ANNUAL RUNOFF IN PERCENT

FIGURE 13



SUMMARY OF ANNUAL RUNOFF OF THE TRINITY RIVER NEAR HOOPA

Water Development

Surface water development controls a large portion of the unit's streamflow. The total storage capacity of reservoirs within the unit, as listed in Department of Water Resources Bulletin No. 17, "Dams Within Jurisdication of the State of California," January 1962, is 2,515,000 acre-feet or about 60.3 percent of the mean seasonal runoff. In addition, the diversion data collected in 1958-59 for Bulletin No. 94-2, "Land and Water Use in the Trinity River Hydrographic Unit," listed numerous small ponds and reservoirs with an estimated combined capacity of about 300 acre-feet. Dams within the unit which are under the jurisdiction of the State as well as those owned and operated by the federal government, are listed in Bulletin No. 17 as follows:

Name of dam and owner	Stream	Location	Year completed	Storage capacity acre-feet
Lower Stuarts Fork (La Grange Placer Mines)	Stuarts Fork Creek	Sec. 3, T36N, R10W, MDB&M	1908	500
Lewiston (USBR)	Trinity River	Sec. 8, T33N, R8W, MDB&M	1962	14,600
Trinity (USBR)	Trinity River	Sec. 15, T34N, R8W, MDB&M	1960	2,500,000

It should be noted, however, that Trinity Reservoir began operation in November 1960; hence, the surface runoff of the unit was essentially natural flow through the 50-year base period from October 1910 to September 1960.

Stream Gaging Stations and Records

All stream gaging stations in the Trinity River Hydrographic Unit have relatively short records, with the exception of the Trinity River gage at Lewiston, which has been continuously recorded since 1911. Table 11 lists all gaging stations within the unit, as shown in the department's "Index of Gaging Stations in and Adjacent to California." The location of stations used in this report are shown on Plate 1.

TABLE 11

STREAM GAGING STATIONS IN THE TRINITY RIVER HYDROGRAPHIC UNIT

USGS Station No.	DWR Ref. No.	Station	Drainage area in sq. miles	Period of record
11-5232.00	F41865	Trinity River above Coffee Creek, near Trinity Center	149	1957-date
11-5235.00	F48135	Coffee Creek at Coffee	102	1910-13
11-5237.00	F41820	Coffee Creek near Trinity Center	107	1957-date
11-5240.00	F41770	Trinity River near Trinity Center	300	1910-13
11-5245.00	F41750	Swift Creek near Trinity Center	34.8	1910-14
11-5250.00	F43100	East Fork Trinity River near Trinity Center	109	1910-14
*11-5255.00	F41640	Trinity River at Lewiston	726	1911-date
11-5256.30	F41580	Grass Valley Creek near Lewiston	36.8	1942-46
11-5256.00	F41560	Indian Creek near Douglas City	34.2	1942-46

TABLE 11 (Continued)

USGS Station No.	DWR Ref. No.	Station	Drainage area in sq. miles	Period of record
11-5258.00	F41540	Weaver Creek near Douglas City	48.4	1958-date
11-5258.00	F41530	Reading Creek near Douglas City	26.3	1942-45
11-5259.00	F41510	Browns Creek near Douglas City	71.6	1957-date
*11-5260.00	F41480	Trinity River near Douglas City	1,017	1943-51
*11-5265.00	F42100	North Fork Trinity River at Helena	151	1911-13, 1957-date
*11-5270.00	F41375	Trinity River near Burnt Ranch	1,438	1931-40, 1956-date
11-5274.00	F41292	New River at Denny	173	1959-date
11-5275.00	F41290	New River near Denny	179	1927-28
11-5280.00	F41200	Trinity River near China Flat	1,733	1911-13
11-5281.00	F44900	South Fork Trinity River at Forest Glen	208	1959-date
*11-5282.00	F44800	South Fork Trinity River near Hyampom	342	1956-date
*11-5284.00	F44650	Hayfork Creek near Hayfork	87.2	1956-date
*11-5284.00	F44500	Big Creek near Hayfork	27.1	1957-date
*11-5285.00	F44400	Hayfork Creek near Hyampom	379	1953-date
*11-5290.00	F44170	South Fork Trinity River near Salyer	899	1950-date
11-5295.00	F44100	South Fork Trinity River near China Flat	909	1911-13

TABLE 11 (Continued)

USGS Station No.	DWR Ref. No.	Station	Drainage area in sq. miles	Period of record
11-5298.00	F41140	Willow Creek at Willow Creek	43.3	1959-date
*11-5300.00	F41090	Trinity River at Hoopa	2,846	1911-14, 1916-18, 1931-date

* Stations for which unimpaired flows are tabulated in this report.

Streamflow Estimates

Estimates of monthly and annual full natural flows for the 50-year period from 1910-11 through 1959-60 were compiled for all gaging stations within the Trinity River Hydrographic Unit for which five or more years of record were available, with one exception: the gaging station Coffee Creek near Trinity Center was omitted because no adequate correlation could be found to extend the record to cover the 50-year base period. A brief description of the methods used for individual gaging stations is included with the tabulations of streamflow, Tables 13 through 22. Detailed data on correlations used, other correlations attempted, adjustment factors, etc., are available in the files of the North Coastal Area Investigation. In some streams where irrigation diversions were considered to be significant, a correction factor was applied to the streamflows, but in areas of little development, no correction was applied and the streamflow was used as the full natural flow. The records to which corrections were applied are noted in the station descriptions in Tables 13 to 22.

Mean seasonal full natural flows for the 50-year period from 1910-11 through 1959-60 for the gaging stations, intermediate areas between gages, and ungaged areas within the unit are summarized in Table 12.

Estimated mean monthly distribution of natural runoff from the Trinity River Hydrographic Unit by subunits and pertinent gaging stations is presented in Table 23.

TABLE 12

SUMMARY OF MEAN SEASONAL FULL NATURAL FLOWS
IN THE TRINITY RIVER HYDROGRAPHIC UNIT
FOR THE 50-YEAR PERIOD FROM 1910-11 THROUGH 1959-60

Gaging station or intermediate area	Mean full natural flow (in acre-feet)	
Trinity River above Coffee Creek, near Trinity Center	270,000	
Coffee Creek near Trinity Center	185,000	
Coffee Creek and Trinity Center to Lewiston	752,000	
Trinity River at Lewiston	1,207,100	
Weaver Creek near Douglas City	41,400	
Browns Creek near Douglas City	48,400	
Lewiston, Browns, and Weaver Creeks to Douglas City	124,500	
Trinity River near Douglas City	1,421,400	
N. F. Trinity River at Helena	293,900	
Douglas City and Helena to Burnt Ranch	334,500	
Trinity River near Burnt Ranch	2,049,800	
S. F. Trinity River near Hyampom	456,100	
Hayfork Creek near Hayfork	81,900	
Big Creek near Hayfork	26,000	
Hayfork and Big Creek to Hyampom	217,300	
Hayfork Creek near Hyampom	325,200	
S. F. and Hayfork Creek to Salyer	306,100	
S. F. Trinity River near Salyer	1,087,400	
Burnt Ranch and Salyer to Hoopa	836,300	
Trinity River near Hoopa	3,973,000	
Ungaged area below Hoopa gaging station	198,000	
Unit Total		4,171,000

TABLE 13

RUNOFF OF TRINITY RIVER AT LEWISTON

Location: Lat. 40° 42' 40", Long. 122° 48' 20", SW 1/4 Sec. 17, T33N, R8W, MDB&M, on left bank 0.3 mile upstream from old highway bridge in Lewiston and 0.5 mile downstream from Deadwood Creek.
Drainage area: 726 square miles
Records available: August 1911 to date
Recorded extremes: Maximum discharge, 71,600 cfs (December 22, 1955); minimum 23 cfs (July 30, 1924)
Remarks: Flow regulated by Trinity Lake beginning November 1960. Small diversions above Trinity Lake for irrigation, power, and mining.

Recorded flows at this station were adjusted to full natural flows by adding estimated depletions by irrigation and mining. Beginning in November 1960, flows were adjusted to correct for storage in Trinity Reservoir.

Monthly and seasonal flow estimates for the year 1910-11 were obtained by correlation with the gaging station Sacramento River at Red Bluff.

Unimpaired flows at this station are tabulated on the following page.

TABLE 13 (CONTINUED)

RUNOFF OF TRINITY RIVER AT LEWISTON

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F41640
LOCATION LAT 40-42-40N, LONG 122-48-20W
SW1/4 SEC.17, T33N, R8W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 726 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	16700	37000	61200	88700	140400	310600	328400	352400	183800	43700	13600	11300	1587800
1912	13200	13700	14400	81800	89800	91100	116800	329200	197400	49700	16200	26200	1039500
1913	15600	82600	59700	55900	84400	108700	209800	273200	124400	40500	16200	12200	1083200
1914	10800	32200	66900	309500	217500	330700	374700	395200	205400	66700	16900	13300	2039800
1915	31500	19600	25300	65700	279500	346600	416700	433200	376400	127500	29100	13600	2164700
1916	12100	19200	78000	58200	262500	331600	257700	231200	167400	69000	17900	11500	1516300
1917	10500	12500	20800	19600	57700	55300	133700	198100	115300	21900	8400	7200	661000
1918	6100	21900	42900	36500	61600	114600	173700	98300	31100	9300	5900	10600	612500
1919	16900	22800	23000	82900	146500	140600	300700	296100	88200	24800	9100	8200	1159800
1920	10100	10200	32600	26800	21700	42800	92300	113100	44100	13500	5200	5400	417800
1921	13000	182400	124400	188500	172400	286600	236700	312100	208300	54100	16400	9800	1804700
1922	11300	21300	36100	30900	45700	76200	155700	268100	112300	21600	8400	5300	792900
1923	17900	20700	37000	52000	46100	84200	170700	162100	62600	23700	9500	8900	695400
1924	16900	14100	18800	21000	80900	32500	43800	28300	8100	4000	3600	3400	275400
1925	17100	95000	66200	71200	288400	161600	334700	282100	122300	36700	13100	19800	1508200
1926	14800	19300	43300	26900	167400	135600	261700	97000	29500	10300	5800	5700	817300
1927	14000	180400	220400	143500	255400	204600	259700	288100	189300	51200	17000	11300	1834900
1928	12600	77200	43500	82900	133400	228600	196700	205100	51500	19100	8700	7600	1066900
1929	9900	24000	26200	30300	47500	84200	79800	147100	60600	16200	6800	4900	537500
1930	8000	7600	153400	41700	122400	152600	160700	104100	44800	14300	7100	7000	823700
1931	8000	10600	15400	34700	42700	84800	87600	66300	41900	10200	4600	4200	411000
1932	8900	11100	22200	31900	40000	172600	124600	208100	78000	19000	7800	5300	729500
1933	6200	16000	16800	16900	18900	136600	188700	172100	186200	36200	10300	7600	812500
1934	7600	10100	29000	80400	107600	177600	147700	81000	29300	10500	6100	5100	692000
1935	13700	84000	56100	60200	101000	80800	248900	222400	72500	19800	8400	7300	975100
1936	10700	13400	22200	132400	158500	137200	209800	194200	103500	32400	11500	8400	1034200
1937	7500	8100	9600	10900	21500	125400	260900	335400	167200	40900	12900	8700	1009000
1938	17200	166700	238700	116900	174800	281900	338300	464700	232400	56400	16000	10400	2114400
1939	21600	34300	51000	36800	37500	129200	139800	79700	30300	10800	6000	6100	583100
1940	8200	8500	88200	200400	344700	324100	274600	236100	90600	23400	11100	12700	1622600
1941	16600	29500	158800	240300	269000	376800	368000	534800	342100	159900	39800	21700	2557300
1942	16800	36100	276400	215300	235300	106100	239800	358400	234400	64200	19500	11900	1814200
1943	11200	44300	84600	121800	141200	193400	235500	157900	78700	29000	12300	8200	1118100
1944	15300	29400	23000	30200	67200	95400	104900	171400	82100	26600	11300	7600	664400
1945	9500	52100	99400	80200	183300	80300	187300	229900	89100	28100	11700	7700	1058600
1946	29300	74100	210600	150000	78300	149500	262300	293500	111000	41100	15300	10100	1425100
1947	11600	42500	46400	26900	83600	146800	146200	112300	86100	21100	11100	8300	742900
1948	54200	35900	26100	218300	46700	61000	220400	259300	215800	45700	18300	14300	1216000
1949	18800	26200	27700	20300	55200	237200	301300	267600	97500	27400	12800	9100	1101100
1950	10200	16100	15800	52900	79900	147900	206800	207500	82800	24700	10500	9600	864700
1951	134300	135100	277300	109700	236000	134500	234000	231400	81200	25800	12900	9200	1621400
1952	19400	54400	166900	79000	208900	187000	380300	410900	204600	80600	23600	13400	1829000
1953	11400	14800	60500	332300	142800	149500	248400	258600	255700	106700	27700	16100	1624500
1954	18800	102300	73700	104700	232000	260300	371500	271400	97300	37300	21500	16800	1607600
1955	15900	70100	76000	44100	52700	63300	91900	202800	87400	23500	10600	9300	747600
1956	10200	33000	327800	353500	155800	173300	297700	393700	206700	56600	19700	12300	2040300
1957	17100	25200	27700	25300	179700	199800	161500	283400	118400	30000	13600	15100	1096800
1958	118200	98600	120700	178300	649300	231800	309100	558600	298400	94900	33900	16100	2707900
1959	13900	19900	20800	201800	122700	155500	224100	166700	83300	23100	11300	13500	1056600
1960	11400	10500	13500	33900	167100	216400	168500	211500	155600	29900	12800	8700	1039800
TOTAL	952700	2226600	3877000	4854800	7155100	8335300	11085100	12255700	6462900	1953600	679800	518000	60356600
MEAN	19100	44500	77500	97100	143100	166700	221700	245000	129300	39100	13600	10400	1207100
PERCENT	1.6	3.7	6.4	8.0	11.9	13.8	18.4	20.3	10.7	3.2	1.1	0.9	100.0

TABLE 14

RUNOFF OF TRINITY RIVER NEAR DOUGLAS CITY

Location: Lat. 40° 40', Long. 122° 59', in SW 1/4 Sec. 34, T33N, R10W, MDB&M, 800 feet downstream from Browns Creek and 2.6 miles northwest of Douglas City.
Drainage area: 1,017 square miles.
Records available: April 1944 to September 1951 (discontinued).
Recorded extremes: Maximum discharge, 41,800 cfs (January 7, 1948); minimum discharge, 93 cfs (September 6, 1947)
Remarks: A few small diversions for power, irrigation, and placer mining above station.

Recorded flows at this station were adjusted to full natural flows by adding estimated depletions by irrigation and mining.

Seasonal flow estimates for 1910-11 through 1942-43 and 1951-52 through 1959-60 were obtained by a least squares correlation, utilizing data processing program No. 121 (currently No. 3020.80). Data from this correlation are:

$$\log Y = -0.757 + 1.1908 \log (X + 1,000)$$

Y = flow of Trinity River near Douglas City, in 100 acre-feet

X = flow of Trinity River at Lewiston, in 100 acre-feet

$\bar{r}$ = correlation coefficient = 0.9972

$\bar{S}y$ = standard error of estimate = 89

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using the gaging station on the Trinity River at Lewiston as the base station. In water year 1942 the monthly distribution was adjusted to eliminate illogical accretions between the gages near Douglas City and near Burnt Ranch.

TABLE 14 (Continued)

Monthly and seasonal unimpaired flows for this station are tabulated on the following page.

TABLE 14 (CONTINUED)

RUNOFF OF TRINITY RIVER NEAR DOUGLAS CITY

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F41480
LOCATION LAT 40-40N, LONG 122-59W
SW1/4 SEC. 34, T33N, R10W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 1017 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	19300	44600	75800	110200	181800	395000	381900	397500	206200	49900	16100	13800	1892100
1912	14600	15900	17200	97600	111900	111300	130500	356600	212700	54600	18400	31000	1172300
1913	17400	95200	71000	66500	104800	132500	233800	295100	133600	44300	18400	14300	1226900
1914	12600	39500	84700	392400	287800	429500	444900	455200	235100	77800	20400	16600	2496500
1915	38100	24400	32500	84900	377000	458600	504100	508100	439000	151800	35500	17500	2671500
1916	13700	22500	94100	70400	331500	410900	292100	254000	182800	76900	20700	13700	1783300
1917	11400	14000	24000	22700	69800	65500	144800	208000	120400	23300	9200	8200	721300
1918	6500	23900	48300	41000	72400	132100	182900	100500	31600	9600	6300	11800	666900
1919	18900	26300	27200	98900	182300	171600	335700	320500	94800	27200	10200	9700	1323300
1920	10800	11200	37200	30600	25800	50000	98700	117200	45500	14200	5600	6100	452900
1921	15100	220400	154700	234700	224300	365800	276400	353100	234200	62000	19400	11800	2171900
1922	12400	24100	42200	36300	55800	91400	170900	285400	118800	23300	9400	6100	876100
1923	19100	23000	42400	59700	55200	99000	183600	169000	64900	25100	10400	10200	761600
1924	17900	15400	21200	23700	95300	37600	46200	29000	8300	4200	3900	3800	306500
1925	19400	112000	80400	86600	366500	201300	381500	311800	134400	41100	15200	23800	1774000
1926	15700	21200	49100	30500	198400	157600	278200	100100	30300	10700	6200	6400	904400
1927	16300	217600	274300	178800	332200	260900	302800	325800	213000	58600	20200	14100	221460
1928	13700	87200	50600	96600	162300	272900	214700	217000	54300	20500	9700	8700	120820
1929	10500	26300	29600	34400	56300	97900	84800	151500	62100	16900	7300	5500	58310
1930	8400	8200	173500	47100	144700	177000	170500	107100	45800	14800	7700	7800	91260
1931	8400	11500	17300	39000	50100	97700	92100	67700	42500	10500	5000	4700	44650
1932	9500	12400	25400	36600	47900	202900	134000	216900	80900	20000	8500	6000	80100
1933	6700	18100	19700	19800	23100	164000	207200	183300	197200	39100	11400	8900	89850
1934	7900	10900	32300	89800	125400	202900	154400	82100	29500	10800	6500	5700	75820
1935	15000	95500	65800	70600	123900	97200	273800	237200	76900	21300	9300	8400	109490
1936	11600	15200	25900	154700	193500	164200	229800	206100	109300	34800	12700	9600	116740
1937	8400	9300	11400	13000	26900	154400	293800	366300	181500	45200	14700	10300	113520
1938	20600	206900	305600	149700	234000	369900	405800	541000	268800	66600	19500	13000	260140
1939	22700	37200	57100	41100	43900	148500	146700	81100	30600	11100	6400	6700	63310
1940	9200	9800	106500	242200	434800	401300	310800	259100	98700	26000	12600	15100	192610
1941	20400	37500	208800	316600	370000	508300	453800	640000	406900	193900	49800	28100	323410
1942	19600	43600	345300	269100	445100	173300	208600	323100	238000	80800	23100	14900	218450
1943	12000	50100	98900	142400	172400	231700	258000	167700	83100	31100	13700	9400	127050
1944	16300	32500	26200	34500	80200	111700	112300	177600	84700	28000	12300	8600	72490
1945	10600	58900	107200	88000	226000	102700	204300	257300	99100	31700	13200	9800	120880
1946	33300	92100	290000	196500	94100	171700	296700	316100	116100	44200	17800	11800	168040
1947	14500	48000	50500	29300	101800	171100	160800	117900	91900	22900	13000	9600	83130
1948	57500	38200	28100	242500	54200	72200	257300	286700	230800	51700	20000	16500	135570
1949	21600	29500	34100	24700	67100	315900	351500	296000	106000	29300	14500	11200	130140
1950	11100	18000	17700	61800	102400	181500	229200	219400	86500	26300	11700	10900	97650
1951	157500	167600	343500	157700	319600	161700	248800	253100	91600	30400	15400	11500	195840
1952	22800	66100	209900	99300	274500	240800	448000	469700	232600	93500	28100	16600	220190
1953	13100	17500	74400	410600	184100	188900	287200	290100	285000	121400	32600	19600	192450
1954	21500	120900	89800	127800	295900	325700	425200	301000	107100	41900	24900	20300	190200
1955	17000	78000	87200	50700	63200	74500	98800	211400	90700	24800	11600	10600	81850
1956	11900	40400	414800	447700	206000	224700	352900	452800	236300	65700	23800	15400	249240
1957	18700	28700	32500	29600	220000	240000	177400	302000	125400	32400	15100	17600	123940
1958	130700	112700	142800	210400	800600	280100	342300	598700	333600	103300	37700	19000	311190
1959	19600	29000	31200	303100	192200	238900	314800	227200	118100	31900	16000	20400	154240
1960	16200	15400	20500	51300	264000	335100	238600	290400	222700	41700	18300	13300	15275
TOTAL	1077700	2624400	4750400	5993700	9273000	10471900	12573900	13501500	7169900	2219100	789400	624400	710693
MEAN	21600	52500	95000	119900	185500	209400	251500	269900	143400	44400	15800	12500	14214
PERCENT	1.5	3.7	6.7	8.4	13.1	14.7	17.7	19.0	10.1	3.1	1.1	0.9	100.

TABLE 15

RUNOFF OF NORTH FORK TRINITY RIVER AT HELENA

Location: Lat. 40° 46' 55", Long. 123° 07' 40", in SW 1/4 of SW 1/4 of Sec. 21, T34N, R11W, MDB&M, on right bank 500 feet downstream from East Fork of North Fork, 0.6 mile north of Helena, and 1.0 mile upstream from mouth.
Drainage area: 151 square miles.
Records available: August 1911 to September 1913, January 1957 to date.
Recorded extremes: Maximum discharge, 13,500 cfs (January 12, 1959), minimum discharge, 13 cfs (September 24-25, 1957).
Remarks: No known regulation or diversion above station.

Recorded flows at this station were taken as full natural flows.

Seasonal flow estimates for 1910-11 and 1913-14 through 1956-57 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$Y = 72{,}400 + 0.0557\ X$

Y = seasonal natural flow, N.F. Trinity River at Helena

X = seasonal natural flow, Trinity River near Hoopa

$\bar{r}$ = correlation coefficient = 0.9669

$\bar{S}y$ = standard error of estimate = 33,600

The monthly distribution of the estimates seasonal flows was determined by the percent deviation method, utilizing data processing program No. 3014.15.2. The gaging station Trinity River at Lewiston was used as the base station.

Monthly and seasonal unimpaired flows at this station are tabulated on the following page.

TABLE 15 (CONTINUED)

RUNOFF OF NORTH FORK TRINITY RIVER AT HELENA

TYPE OF RECORD—UNIMPAIRED

INDEX NO. F42100
LOCATION LAT 40-46-55N, LONG 123-07-40W
SW1/4 SW1/4 SEC. 21, T34N, R11W, MDBM

SOURCE OF RECORD DWR
UNIT ACRE-FEET
AREA 151 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	2700	13300	20600	30500	44400	91300	64600	52100	28500	9400	2900	2000	362300
1912	2100	2500	2600	49500	53500	30600	30000	66400	36500	12100	4200	6100	296100
1913	2900	46800	23600	22000	35600	41900	58100	51700	24800	11000	3900	1600	323900
1914	1600	10400	20200	95100	61500	87000	66000	52300	28500	12800	3200	2100	440700
1915	5000	6900	8300	22000	86300	99500	80000	62500	57100	26700	6100	2400	462800
1916	1900	6600	24900	18900	78600	92300	48000	32400	24600	14000	3600	1900	347700
1917	3000	7800	12200	11700	31700	28200	45700	50900	31100	8200	3100	2200	235800
1918	1300	10200	18600	16200	25100	43400	44000	18700	6200	2600	1600	2400	190300
1919	3000	9000	8500	31100	50600	45100	64500	47800	15000	5800	2100	1600	284100
1920	2700	6000	17900	15000	11200	20500	29700	27300	11200	4700	1800	1600	149600
1921	1900	57700	36700	56800	47800	73800	40800	40500	28400	10200	3100	1500	399200
1922	2500	10200	16200	14100	19200	29800	40700	52500	23200	6200	2400	1200	218200
1923	3800	9600	16000	22900	18700	31800	43200	30800	12500	6500	2600	2000	200400
1924	4700	8600	10700	12200	43300	16200	14600	7100	2100	1500	1300	1000	123300
1925	2700	32700	21300	23300	87000	45300	62800	39800	18100	7500	2700	3300	346500
1926	2700	7700	16200	10200	58600	44100	57000	15900	5100	2500	1400	1100	222500
1927	2000	55800	63700	42300	69400	51600	43800	36600	25200	9400	3100	1700	404600
1928	2100	27900	14700	28600	42300	67400	38800	30400	8000	4100	1900	1400	267600
1929	2300	12200	12400	14600	21100	34900	22100	30600	13200	4900	2100	1200	171600
1930	1400	2900	54200	15000	40600	47000	33200	16100	7300	3200	1600	1300	223800
1931	2000	5800	7800	18000	20400	37800	26100	14800	9800	3300	1500	1100	148400
1932	2000	5600	10400	15200	17500	70300	34000	42700	16800	5700	2300	1300	223800
1933	1400	7900	7700	7900	8200	54900	50700	34800	39500	10600	3000	1800	228400
1934	1200	3700	9800	27800	34300	52500	29300	12100	4600	2300	1300	900	179800
1935	2600	35200	22000	24000	37100	27600	57000	38200	13100	4900	2100	1500	265300
1936	2000	5400	8400	50800	55800	45000	46100	32100	17900	7800	2800	1700	275600
1937	1500	3500	3900	4500	8100	44100	61400	59400	31100	10500	3300	1800	23310
1938	2700	58600	78400	39100	53900	80700	64900	67000	35200	11800	3300	1800	49740
1939	4700	16600	23100	17000	15900	51200	37000	15900	6300	3100	1700	1500	19400
1940	1100	2600	25500	59000	93700	81700	46300	29900	12100	4300	2000	1900	36010
1941	2000	8000	40100	61800	63700	82800	54200	59200	39800	25700	6400	2900	44660
1942	2200	10500	74600	59400	59700	25000	37900	42500	29200	11100	3400	1700	35720
1943	2100	18300	32600	47900	51100	65200	53000	26700	14000	7100	3000	1700	32270
1944	3100	13200	9600	12900	26400	34900	25700	31500	15800	7100	3000	1700	18490
1945	1700	20100	35900	29500	61900	25300	39500	36400	14800	6500	2700	1500	27580
1946	4700	26100	69300	50300	24200	42900	50400	42400	16800	8600	3200	1700	34060
1947	2100	16700	17000	10100	28800	46800	31300	18100	14500	4900	2600	1600	19450
1948	8700	12800	8700	74100	14600	17700	42800	37900	33100	9700	3900	2500	26650
1949	3300	10000	9900	7400	18500	73900	62900	42000	16100	6200	2900	1700	25480
1950	2200	7500	6900	23600	32800	56500	52800	39800	16700	6900	2900	2200	25080
1951	20200	44900	86200	34700	68800	36400	42400	31500	11600	5100	2600	1500	38590
1952	3300	20200	57800	27900	67900	56500	76800	62500	32700	17800	5200	2400	43100
1953	1900	5400	20400	114200	45300	44100	49000	38300	39800	23000	6000	2900	39030
1954	2900	34400	23100	33500	68300	71000	68000	37400	14100	7500	4300	2800	36730
1955	3100	29900	30300	17900	19700	22000	21400	35400	16000	6000	2700	2000	20640
1956	1500	10900	101400	111300	45200	46800	53800	53400	29500	11200	3900	2000	47090
1957	3000	6500	7000	6900	45900	66400	33500	43300	20400	7000	2400	2400	24470
1958	16600	34100	44500	63200	181800	45000	62500	64000	30000	14800	5100	2200	56380
1959	1800	5400	5600	69300	35700	39500	35400	17800	12000	4200	1800	2400	23090
1960	2000	1500	1800	7200	56400	56100	30900	38900	27300	6100	2200	1300	23170
TOTAL	161900	826100	1299200	1678400	2288100	2522300	2304600	1908300	1037200	424100	148200	96000	1469440
MEAN	3200	16500	26000	33600	45800	50400	46100	38200	20700	8500	3000	1900	2939
PERCENT	1.1	5.6	8.8	11.4	15.6	17.3	15.7	13.0	7.0	2.9	1.0	0.6	100

TABLE 16

RUNOFF OF TRINITY RIVER NEAR BURNT RANCH

Location: Lat. 40° 47' 20", Long. 123° 26' 20", in SW 1/4 Sec. 19, T5N, R7E, HB&M, on left bank 700 feet upstream from Highway 299 bridge at Cedar Flat and 2.3 miles southeast of town of Burnt Ranch.
Drainage area: 1,438 square miles.
Records available: October 1931 to September 1940, October 1956 to date.
Recorded extremes: Maximum discharge, 81,500 cfs (February 25, 1958) minimum discharge, 82 cfs (August 31, 1939)
(Note: Flood of December 22, 1955 estimated at 172,000 cfs).
Remarks: Flow regulated by Trinity Lake beginning in November 1960. Small diversions above station for mining and irrigation.

Recorded flows at this station were adjusted to full natural flows by adding estimated depletions by irrigation and mining. Beginning in November 1960, flows were adjusted to correct for storage in Trinity Reservoir.

Estimates of seasonal natural flows for 1910-11 through 1930-31 and 1940-41 through 1955-56 were obtained by a least squares correlation, utilizing data processing program No. 121 (currently 3020.80.1). Data from this correlation are:

$$Y = -108{,}800 + 1.8124\ X$$

Y = seasonal natural flow, Trinity River near Burnt Ranch

X = seasonal natural flow, Trinity River at Lewiston

$\bar{r}$ = correlation coefficient = 0.9989

$\bar{S}y$ = 562,000

TABLE 16 (Continued)

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using the gaging station on the Trinity River at Lewiston as the base station. The monthly distribution of seasonal flows in water years 1941, 1942, and 1956 were adjusted to eliminate illogical accretions.

Monthly and seasonal unimpaired flows at this station are tabulated on the following page.

TABLE 16 (CONTINUED)

RUNOFF OF TRINITY RIVER NEAR BURNT RANCH

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F41376
LOCATION LAT 40-47-20N, LONG 123-26-20W
SW1/4 SEC. 19, T5N, R7E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 1438 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	27600	67800	122300	199000	280300	596800	537000	521400	291100	80100	23400	22100	2768900
1912	21700	24900	28600	181500	177300	173000	189000	482000	309000	90400	27700	51100	1756200
1913	25400	149300	117300	122900	165300	204900	336700	396600	193200	73100	27500	23700	1835900
1914	17400	57500	129900	674400	421800	617300	595300	568100	316000	119100	28200	25400	3570400
1915	52900	36700	51400	149900	566400	676100	691900	651000	605000	238000	50600	27000	3796900
1916	19300	34000	150700	126200	506400	615600	407500	330800	256100	122600	29600	21900	2620700
1917	16800	22100	40200	42500	111100	102400	210800	282800	176000	38800	13900	13700	1071100
1918	9200	36400	77600	74000	111300	199100	256900	131500	44500	15500	9200	18900	984100
1919	27400	41300	45100	182600	287400	265200	483300	430600	137000	44700	15200	15800	1975600
1920	14700	16400	57300	52700	38000	72100	132400	146900	61300	21800	7800	9300	630700
1921	20900	324900	241000	409000	333200	532700	374900	447100	319000	96100	27300	18400	3144500
1922	18600	38600	71200	68300	89900	144300	251100	391300	175200	39000	14300	10300	1312100
1923	27800	35800	69600	109500	86500	151900	262200	225400	93000	40900	15400	16500	1134500
1924	20600	19000	27600	34500	118500	45700	52500	30700	9400	5400	4500	4900	373300
1925	27500	170800	129600	156000	562800	303200	535100	407900	189200	65800	22000	38100	2608000
1926	22800	32900	80600	55900	310400	241800	397500	133300	43300	17500	9200	10400	1355600
1927	22100	320300	425800	310600	492000	379100	409600	411400	289100	90900	28300	21500	3200700
1928	19700	134400	82400	175700	251700	415200	304200	286900	77100	33200	14200	14000	1808700
1929	14900	40200	47700	61800	86200	147000	118700	198000	87200	27000	10700	8800	848200
1930	12000	12600	279300	84900	222100	266500	238900	140000	64500	24000	11000	12500	1368300
1931	11300	16500	26100	65900	72200	137900	121300	83000	56100	15800	6700	7000	619800
1932	16600	22900	56300	90500	88000	295800	199100	287000	129300	35800	12500	8200	1242000
1933	9500	22900	32700	39600	50700	263800	287100	255000	259300	66200	17400	11000	1315200
1934	11500	17200	59800	154700	157700	251800	209200	123100	50400	19000	10100	8500	1073000
1935	22000	148800	106900	148600	183000	153700	417400	326700	119200	36500	15300	12500	1690600
1936	19700	24600	44700	360700	305100	240200	292300	259900	153200	58900	19500	12600	1791400
1937	11800	13200	16400	19900	46900	280200	442900	459700	252600	67600	19600	12800	1643600
1938	28400	291900	396000	235700	401000	622200	601800	710900	344400	95000	32200	18700	3778200
1939	37000	62500	109800	72200	86900	240800	211500	122300	54600	20900	9400	8600	1036500
1940	12900	14500	166200	422500	647000	585300	422000	328400	134600	40200	17700	23300	2814600
1941	23600	46500	273900	464500	463000	623700	518700	717000	458000	227000	59300	36800	3912000
1942	26800	64000	534800	466500	611000	238000	286000	444000	326000	108600	32300	22800	3160800
1943	17300	76100	158500	255600	263900	347700	360400	218600	116600	49800	19700	15100	1899300
1944	23700	50700	43100	63500	125600	171700	160800	237700	121800	45700	18200	14000	1076500
1945	15000	91000	189100	170900	347700	146500	290800	323200	133900	48900	19100	14500	1790600
1946	46800	131400	406700	324600	150500	276800	413700	418800	169300	72700	25400	19100	2455800
1947	17800	72300	86100	55900	154500	261200	221400	153800	126200	35900	17600	15200	1217900
1948	87400	63900	50800	475300	90500	113700	350000	372400	331800	81500	30500	27400	2075200
1949	30900	47900	55200	45000	109400	452600	489500	393400	153200	50000	21700	17900	1866700
1950	16200	28300	30400	114000	153000	272700	324700	294800	125900	43600	17200	18200	1439000
1951	212700	237100	530000	234900	449800	246600	365200	326600	122600	45100	21200	17400	2809200
1952	32100	99800	333900	176900	416400	358600	620900	607400	323600	146000	40400	26300	3182300
1953	17900	25800	115300	709900	271400	273300	386900	364300	385600	186800	45400	30200	2812800
1954	30200	182700	143200	227600	449500	485200	589700	389700	149500	66400	35900	32400	2782000
1955	24800	121300	143100	93000	98900	114200	141100	282000	130000	40500	17200	17200	1223300
1956	16100	57900	627600	758200	297500	423000	453000	486000	290900	99100	32600	23000	3564900
1957	32100	50800	51900	49200	288100	408600	261600	430500	185800	55100	22800	24800	1861300
1958	169400	209100	251000	382000	1349200	462900	557700	730500	423700	147700	53600	31400	4768200
1959	21900	37500	40400	378500	268600	277700	327600	224400	126400	40800	18200	22900	1784900
1960	20700	18500	24100	58100	314300	350100	244100	294800	226100	48800	20500	14300	1634400
TOTAL	1503400	3963500	7379200	10386300	13929900	15526400	17353900	17279600	9716800	3379800	1119200	948400	102486400
MEAN	30100	79300	147600	207700	278600	310500	347000	345600	194300	67600	22400	19000	2049700
PERCENT	1.5	3.9	7.2	10.1	13.6	15.1	16.9	16.9	9.5	3.3	1.1	0.9	100.0

TABLE 17

RUNOFF OF SOUTH FORK TRINITY RIVER NEAR HYAMPOM

Location: Lat. 40° 36' 00", Long. 123° 26' 50", in NE 1/4 Sec. 36, T3N, R6E, HB&M, on left bank 0.4 mile upstream from Deep Gulch, 1.0 mile upstream from Hayfork Creek, and 1.2 miles south of Hyampom.
Drainage area: 342 square miles.
Records available: September 1956 to date.
Recorded extremes: Maximum discharge, 26,600 cfs (February 8, 1960); minimum discharge, 25 cfs (September 27, 1962) (Note: Flood of December 22, 1955 estimated at 39,400 cfs).
Remarks: No regulation or diversion above station.

Recorded flows at this station were taken as full natural flows.

Estimates of seasonal flows for 1910-11 through 1955-56 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$\log Y = \log 0.06790 + 1.2401 \log X$$

Y = seasonal natural flow, S. F. Trinity River near Hyampom, in 100 acre-feet

X = seasonal flow, S. F. Trinity River near Salyer minus Hayfork Creek near Hayfork, in 100 acre-feet

$\bar{r}$ = correlation coefficient = 0.9936

$\bar{S}y$ = standard error of estimate = 213

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gaging station South Fork Trinity River near Salyer was used as the base station.

Recorded and estimated unimpaired flows at this station are tabulated on the following page.

TABLE 17 (CONTINUED)

RUNOFF OF SOUTH FORK TRINITY RIVER NEAR HYAMPON

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F44800
LOCATION LAT 40-36-00N, LONG 123-26-50W
NE1/4 SEC. 36, T3N, R6E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 342 SQ. MILES

AR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
11	700	2100	6700	80600	73300	65900	57500	35800	22800	5600	3000	1500	355500
12	2000	2600	3100	43500	49500	49800	36100	68200	27200	8600	3800	5900	300300
13	4000	42100	50300	83900	76800	56300	76400	45400	18500	7000	3600	2200	466500
14	400	8100	53000	353000	135800	66800	100800	68600	19500	7500	5500	3300	822300
15	15200	11800	23000	87300	302500	129600	110400	54000	25200	8700	5800	4100	777600
16	4900	9800	60400	64600	240300	113900	97100	47400	21800	7800	5400	3600	677000
17	400	2800	19700	17400	90200	90200	85700	34200	15300	5300	3100	1500	365800
18	400	1200	8200	8200	51800	52100	33300	8300	3700	1300	1000	1000	170500
19	400	3900	9400	85300	154500	74500	94800	23300	7900	3800	2300	1100	461200
20	400	600	7800	2300	1300	21700	28000	26400	3300	2100	600	600	95100
21	3000	91500	96700	212300	143900	86300	38600	30500	12400	4700	3400	1700	725000
22	400	2400	32400	39500	48800	59800	72300	34700	13500	3800	2300	1100	311000
23	1100	3800	28300	56800	28800	12200	57300	12600	7200	3500	1700	1100	214400
24	700	500	3200	8000	29200	3900	3500	1700	600	300	300	200	52100
25	5700	38400	47600	34000	260700	43100	129200	59300	24200	6900	3700	2800	655600
26	700	3000	12800	22600	157800	24200	28100	12900	3900	1800	1100	700	269600
27	1600	65400	60800	87000	267000	97000	101600	27100	13100	5600	2800	1200	730200
28	400	21200	18000	51400	59700	138000	69400	22400	8100	3500	1600	800	394500
29	400	5700	15200	13700	34100	15400	24000	13500	9500	3200	1600	600	136900
30	400	300	76600	29800	68400	55500	28200	18800	7400	3400	1900	1100	291800
31	300	1500	1700	25300	25800	36600	9800	3900	3400	1500	600	300	110700
32	2200	10000	43700	80900	37600	35000	35000	37100	11400	4500	2300	700	300400
33	400	1000	10200	33800	39600	101100	34900	47600	22800	7100	3000	1100	302600
34	700	1300	31100	40900	34100	37000	21000	13700	6000	3500	2100	700	192100
35	1600	32200	22200	86000	38500	79700	132200	30100	9800	3900	2400	1200	439800
36	1200	1400	13400	216500	131700	44600	48300	17400	21800	7000	3100	1100	507500
37	400	300	700	4900	24900	88600	125300	25700	16300	5600	2600	700	296000
38	1800	103900	116300	70500	296300	283600	95300	52600	23000	7600	3600	1800	1056300
39	1400	5300	33400	24000	50700	56500	13500	11200	6000	3200	1800	700	207700
40	400	400	30200	126000	246500	148200	75700	21900	9700	4900	2900	1600	668400
41	1300	5400	106200	163700	144600	115600	134400	53600	25600	11400	6400	2900	771100
42	800	4500	132900	102000	200700	27800	77900	69300	43300	13100	6600	2000	680900
43	800	22000	68200	160000	67200	62200	54800	28200	24200	8000	4000	1600	501200
44	2100	2500	3500	23800	34500	45500	20700	17100	10900	5000	2700	1000	169300
45	800	32200	46800	29200	126600	71500	43700	31900	16500	6200	3100	1100	409600
46	2900	62300	194900	89200	57700	58500	36900	17000	8200	4600	3000	800	536000
47	400	11100	12700	4600	44200	72100	32300	7500	10400	3900	2500	1000	202700
48	9900	6700	4700	30800	42700	54100	152400	57700	31600	9600	5400	3000	408600
49	1900	5700	29400	20200	73900	148300	37200	18200	7500	4200	2300	800	349600
50	400	2100	3200	53000	76100	112900	53600	26800	10700	4900	2700	1100	347500
51	33500	34500	139900	152400	167500	51700	30700	31000	11600	5300	2900	2200	663200
52	4700	19300	124200	92200	215100	102800	121300	60400	23800	10200	5400	3400	782800
53	2900	4100	63300	267600	72800	60100	66600	69200	44200	15400	7100	4100	677400
54	4500	20600	29000	163800	155200	97800	84700	26900	14400	6500	4600	3800	611800
55	3500	13300	33200	37800	30700	24200	31000	39100	12000	5200	2400	1800	234200
56	2500	15700	251100	259000	155100	99600	66300	52600	20400	7900	2000	1900	934100
57	7000	6300	5600	16400	74100	107600	53200	58600	20600	7800	3900	3200	364300
58	22000	46100	82400	177800	458200	110200	129900	52600	18600	8400	4400	2900	1113500
59	2500	4900	7700	110800	91700	56500	37100	18200	7300	3600	2300	2900	345500
60	2300	2200	3400	13200	121400	102000	40200	30800	18900	6800	3100	2000	346300
OTAL	160300	796000	2278400	4057500	5610100	3748100	3168200	1673000	776000	291200	155700	89500	22804000
EAN	3200	15900	45600	81200	112100	75000	63400	33500	15500	5800	3100	1800	456100
ERCENT	0.7	3.5	10.0	17.8	24.6	16.4	13.9	7.3	3.4	1.3	0.7	0.4	100.0

TABLE 18

RUNOFF OF HAYFORK CREEK NEAR HAYFORK

Location: Lat. 40° 31' 10", Long. 123° 05' 05" in SW 1/4 Sec. 23, T31N, R11W, MDB&M, on left bank 1,300 feet downstream from Carrier Gulch and 5.8 miles southeast of town of Hayfork.
Drainage area: 87.2 square miles.
Records available: October 1956 to date.
Recorded extreme: Maximum discharge, 4,210 cfs (February 8, 1960); minimum discharge, 1.2 cfs (September 1, 1957).
Remarks: Records fair.

Recorded flows at this station were adjusted to full natural flows by adding estimated depletions as determined from land and water use data in the department's Bulletin No. 94-2.

Monthly and seasonal flow estimates for the years 1910-11 to 1956-57 were obtained by hand correlation with Hayfork Creek near Hyampom. Data from this correlation are:

$Y = 0.2531\ X$

Y = seasonal natural flow, Hayfork Creek near Hayfork

X = seasonal natural flow, Hayfork Creek near Hyampom

Monthly and seasonal unimpaired flows at this station are tabulated on the following page.

TABLE 18 (CONTINUED)

RUNOFF OF HAYFORK CREEK NEAR HAYFORK

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F44650
LOCATION LAT 40-31-10N, LONG 123-05-05W
SW1/4 SEC. 23, T31N, R11W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 87 SQ. MILES

AR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
11	200	400	1300	13700	13400	13300	10000	5200	3700	1100	700	400	63400
12	500	500	600	7300	9000	9900	6200	9800	4400	1700	900	1500	52300
13	1000	8600	9600	14200	14100	11400	13400	6600	3000	1400	800	600	84700
14	100	1700	10300	61200	25500	13900	18000	10200	3200	1500	1300	900	147800
15	3700	2400	4300	14600	54700	25900	19000	7700	4000	1700	1300	1000	140300
16	1200	2000	11400	10900	43700	22900	16800	6800	3500	1500	1200	900	122800
17	100	600	3700	2900	16200	17900	14600	4900	2400	1000	700	400	65400
18	100	300	1600	1400	9500	10600	5800	1200	600	300	200	300	31900
19	100	800	1800	14600	28400	15200	16600	3400	1300	800	500	300	83800
20	100	100	1700	500	300	5100	5700	4500	600	500	200	200	19500
21	700	18400	18200	35500	26000	17300	6600	4400	2000	900	800	400	131200
22	100	500	6000	6500	8700	11700	12300	4900	2100	700	500	300	54300
23	300	800	5600	10000	5500	2600	10200	1900	1200	700	400	300	39500
24	300	100	800	1700	6600	1000	700	300	100	100	100	100	11900
25	1400	7800	9100	5800	48000	8800	22700	8600	3900	1400	900	700	119100
26	200	600	2300	3600	26900	4600	4600	1700	600	300	200	200	45800
27	400	13100	11400	14600	48300	18800	17300	3900	2100	1100	700	300	132000
28	100	4200	3300	8400	10500	27000	11700	3100	1300	700	400	200	70900
29	100	1200	3100	2500	6800	3400	4600	2100	1700	700	400	200	26800
30	100	100	13600	4700	11700	10600	4600	2600	1100	600	400	300	50400
31	100	300	400	4700	5100	8200	1900	600	600	300	200	100	22500
32	500	2000	8100	13400	6700	6900	6000	5200	1800	900	500	200	52200
33	100	200	1900	5500	7000	19700	5800	6600	3500	1300	700	300	52600
34	200	300	6000	7000	6300	7500	3700	2000	1000	700	500	200	35400
35	400	6600	4200	14500	7100	16100	23000	4400	1600	800	600	300	79600
36	300	300	2600	37800	24900	9300	8700	2600	3600	1400	700	300	92500
37	100	100	100	800	4400	17100	20900	3500	2500	1100	600	200	51400
38	400	19900	20800	11200	51100	54000	15600	7200	3500	1400	800	400	186300
39	400	1000	6300	4000	9100	11300	2300	1600	1000	600	400	200	38200
40	100	100	5700	21100	44900	29700	13100	3100	1500	900	700	400	121300
41	300	1100	20200	27800	26500	23400	23400	7700	4100	2200	1500	800	139000
42	200	900	25800	17600	37400	5700	13800	10200	7100	2600	1600	500	123400
43	200	4500	13100	27500	12500	12800	9700	4100	3900	1600	900	400	91200
44	500	500	700	4100	6500	9400	3700	2500	1800	1000	600	300	31600
45	200	6400	8700	4900	22700	14200	7500	4500	2600	1200	700	300	73900
46	700	12400	36200	14700	10300	11500	6300	2400	1300	900	700	200	97600
47	100	2200	2400	800	7900	14300	5500	1100	1500	800	600	300	37500
48	2500	1400	900	5300	7900	11100	26900	8500	5200	1900	1300	800	73700
49	500	1100	5300	3200	12700	28200	6100	2500	1100	800	500	200	62200
50	100	400	600	8700	13500	22200	9000	3700	1700	900	600	300	61700
51	7900	6800	25700	25000	29700	10100	5200	4300	1800	1000	700	600	118800
52	1200	3700	22400	14800	37500	19700	20000	8300	3600	1900	1200	800	135100
53	700	800	12100	45300	13400	12200	11600	10000	7100	3000	1600	1100	118900
54	1100	2700	3800	27500	29100	20700	16200	4800	2900	1500	1000	1000	112300
55	1000	4000	7500	6600	5700	4800	5700	6300	1900	1100	600	500	45700
56	600	2500	45700	49100	30200	21500	12100	8100	3100	1600	1000	800	176300
57	800	1100	900	2000	13900	15100	8100	10500	2500	900	500	500	56800
58	5800	6500	13400	23900	79900	22500	28500	8400	3600	1400	800	600	195300
59	400	800	1300	17000	14800	12100	5900	2100	1000	500	400	500	56800
60	400	500	700	3500	23200	17800	5200	5400	2400	900	400	400	60800
OTAL	38600	155300	423200	683900	1015700	741000	552800	246000	123600	55800	35500	23000	4094400
EAN	800	3100	8500	13700	20200	14800	11100	4900	2500	1100	700	500	81900
ERCENT	1.0	3.8	10.4	16.7	24.5	18.1	13.6	6.0	3.1	1.3	0.9	0.6	100.0

TABLE 19

RUNOFF OF BIG CREEK NEAR HAYFORK

Location: Lat. 40° 33' 11", Long. 123° 08' 33" in NE 1/4 SE 1/4 Sec. 7, T31N, R11W, on right bank 30 feet upstream from bridge on Hayfork-Douglas City road and 2 miles east of Hayfork.
Drainage area: 27.1 square miles.
Records available: February 1957 to date.
Recorded extremes: Maximum discharge, 1,540 cfs (February 18, 1958), no flow for periods in some years.
Remarks: Small diversion above station for city of Hayfork.

Recorded flows at this station were adjusted to full natural flows by adding estimated depletions for the city of Hayfork and for irrigation.

Monthly and seasonal flow estimates for the years 1910-11 to 1956-57 were obtained by hand correlation with Hayfork Creek at Hyampom. Data from this correlation are:

$Y = 0.080\ X$

Y = seasonal natural flow, Big Creek near Hayfork

X = seasonal natural flow, Hayfork Creek near Hyampom

Monthly and seasonal unimpaired flows at this station are tabulated on the following page.

TABLE 19 (CONTINUED)

RUNOFF OF BIG CREEK NEAR HAYFORK

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F44500
LOCATION LAT 40-33-11N, LONG 123-08-33W
NE1/4 SE1/4 SEC. 7, T31N, R11W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 21 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	100	100	400	4300	4200	4200	3300	1600	1200	300	200	100	20000
1912	200	200	200	2300	2900	3000	2000	3000	1400	500	300	500	16500
1913	300	2700	3000	4500	4500	3600	4200	2100	1000	400	300	200	26800
1914	0	500	3300	19200	8100	4400	5700	3200	1000	500	400	300	46600
1915	1200	700	1400	4600	17300	8200	6000	2400	1300	500	400	300	44300
1916	400	600	3600	3400	13800	7200	5300	2200	1100	500	400	300	38800
1917	0	200	1200	900	5100	5700	4600	1500	800	300	200	100	20600
1918	0	100	500	400	3000	3400	1800	400	200	100	100	100	10100
1919	0	200	600	4600	9000	4800	5300	1100	400	200	200	100	26500
1920	0	0	500	100	100	1600	1800	1400	200	200	100	100	6100
1921	200	5800	5700	11200	8200	5500	2100	1400	600	300	200	100	41300
1922	0	200	1900	2100	2700	3700	3900	1500	700	200	200	100	17200
1923	100	300	1800	3200	1700	800	3200	600	400	200	100	100	12500
1924	100	0	200	600	2200	300	200	100	0	0	0	0	3700
1925	400	2500	2900	1800	15200	2800	7200	2700	1200	400	300	200	37600
1926	0	200	700	1100	8600	1400	1400	600	200	100	100	100	14500
1927	100	4200	3600	4600	15300	5900	5500	1200	700	300	200	100	41700
1928	0	1300	1000	2700	3300	8600	3700	1000	400	200	100	100	22400
1929	0	400	1000	800	2200	1100	1400	700	500	200	100	100	8500
1930	0	0	4300	1500	3700	3300	1500	800	400	200	100	100	15900
1931	0	100	100	1500	1600	2500	600	200	200	100	0	0	6900
1932	200	600	2600	4200	2100	2200	1900	1700	600	300	200	100	16700
1933	0	100	600	1700	2200	6200	1900	2100	1100	400	200	100	16600
1934	100	100	1900	2200	2000	2400	1100	600	300	200	200	100	11200
1935	100	2100	1300	4600	2200	5100	7400	1400	500	200	200	100	25200
1936	100	100	800	12000	8000	2900	2700	800	1100	400	200	100	29200
1937	0	0	0	300	1400	5400	6600	1100	800	300	200	100	16200
1938	100	6300	6600	3600	16100	17100	5000	2300	1100	400	200	100	58900
1939	100	300	2000	1300	2900	3600	700	500	300	200	100	100	12100
1940	0	0	1800	6700	14200	9400	4100	1000	500	300	200	100	38300
1941	100	400	6400	8800	8400	7400	7400	2400	1300	700	500	200	44000
1942	100	300	8100	5600	11900	1800	4400	3200	2200	800	500	200	39100
1943	100	1400	4200	8700	3900	4000	3100	1300	1200	500	300	100	28800
1944	200	200	200	1300	2000	2900	1200	800	600	300	200	100	10000
1945	100	2000	2800	1500	7200	4500	2400	1400	800	400	200	100	23400
1946	200	3900	11400	4600	3300	3600	2000	800	400	300	200	100	30800
1947	0	700	800	200	2500	4600	1700	300	500	200	200	100	11800
1948	800	400	300	1700	2500	3500	8600	2700	1600	600	400	200	23300
1949	100	300	1700	1000	4000	9000	1900	800	400	200	200	100	19700
1950	0	100	200	2800	4200	7000	2900	1200	500	300	200	100	19500
1951	2500	2100	8200	7900	9400	3200	1600	1400	600	300	200	200	37600
1952	300	1200	7100	4700	11800	6200	6300	2600	1200	600	400	300	42700
1953	200	300	3800	14300	4200	3800	3700	3200	2300	1000	500	300	37600
1954	400	800	1200	8700	9200	6600	5100	1500	900	500	300	300	35500
1955	300	1300	2300	2100	1800	1500	1800	2000	600	400	200	200	14500
1956	200	800	14400	15500	9500	6800	3800	2600	1000	500	300	300	55700
1957	400	500	400	800	3200	5900	3500	3100	1500	700	400	300	20700
1958	1100	2400	4200	8100	23200	7400	8400	3300	2000	800	300	300	61500
1959	100	400	600	5400	4100	5800	2800	1100	900	500	400	400	22500
1960	200	100	300	700	5400	5000	2200	1800	1200	500	400	300	18100
TOTAL	11200	49500	134100	216400	315500	236800	176900	78700	41900	18500	12000	8200	1299700
MEAN	200	1000	2700	4300	6400	4700	3500	1600	800	400	200	200	26000
PERCENT	0.8	3.8	10.4	16.5	24.5	18.1	13.5	6.2	3.1	1.5	0.8	0.8	100.0

TABLE 20

RUNOFF OF HAYFORK CREEK NEAR HYAMPOM

Location: Lat. 40° 37' 35", Long. 123° 26' 00", in NW 1/4 Sec. 19, T3N, R7E, on right bank 1.2 miles upstream from mouth and 1.3 miles northeast of Hyampom.
Drainage area: 379 square miles.
Records available: August 1953 to date.
Recorded extremes: Maximum discharge, 25,300 cfs (December 22, 1955), minimum, 16 cfs (September 28, 1960).
Remarks: Records good except those for periods of ice effect or no gage-height record, which are fair. Diversions for irrigation of about 700 acres above station.

Recorded flows at this station were adjusted to full natural flows by adding estimated depletion by irrigation.

Seasonal flow estimates for 1910-11 through 1952-53 were obtained by a least squares correlation with the gaging station Eel River at Scotia. Data from this correlation are:

$Y = -62,600 + 0.07432\ X$

Y = seasonal natural flow, Hayfork Creek near Hyampom

X = seasonal natural flow, Eel River at Scotia

$\bar{r}$ = correlation coefficient = 0.9931

$\bar{S}y$ = standard error of estimate = 28,100

For years in which the estimated flow of Hayfork Creek near Hyampom was less than 150,000 acre-feet, the seasonal flows were adjusted upward to correspond more closely to the flow of South Fork Trinity River near Salyer.

The monthly distribution of estimated seasonal flow was determined by the percent deviation method, utilizing data processing program No. 3014.15.2. The gaging station S. F. Trinity River near Salyer was used as the base station.

Monthly and seasonal unimpaired flows at this station are tabulated on the following page.

TABLE 20 (CONTINUED)

RUNOFF OF HAYFORK CREEK NEAR HYAMPOM

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F44400
LOCATION LAT 40-37-35N, LONG 123-26-00W
NW1/4 SEC. 19, T3N, R7E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 379 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTA
1911	700	1700	5000	54000	53000	52700	39600	20500	14500	4300	2800	1500	25030
1912	2000	2100	2300	28800	35500	39300	24600	38600	17200	6600	3500	6000	20650
1913	3900	33900	38000	56400	55800	45200	52800	26000	11900	5400	3300	2200	33480
1914	400	6600	40800	242100	100700	54800	71100	40200	12700	6000	5100	3500	58400
1915	14600	9300	17100	57700	216100	102300	75000	30400	15800	6600	5300	4100	55430
1916	4800	7800	45100	42900	172500	90500	66300	26900	13800	6000	4900	3700	48520
1917	400	2200	14500	11400	64100	70800	57900	19200	9600	4000	2700	1500	25830
1918	300	1000	6300	5500	37700	41900	23100	4800	2400	1100	900	1000	12600
1919	400	3100	7100	57500	112400	60000	65700	13400	5100	3000	2100	1200	33100
1920	300	500	6800	1800	1200	20400	22600	17600	2500	1900	700	700	7700
1921	2800	72600	71900	140300	102900	68200	26200	17200	7800	3600	3100	1700	51830
1922	400	1900	23700	25700	34400	46500	48500	19300	8300	2800	2000	1100	21460
1923	1100	3200	22100	39400	21600	10100	40600	7500	4800	2800	1700	1100	15600
1924	1000	500	3000	6700	26300	3900	2900	1300	500	300	300	300	4700
1925	5500	31000	36000	22900	189800	34700	89500	34100	15500	5400	3400	2900	47070
1926	600	2200	9000	14100	106700	18100	18100	6900	2300	1300	900	700	18090
1927	1500	51900	45200	57500	191000	74500	68500	15300	8200	4300	2600	1200	52170
1928	400	16500	13100	33300	41800	106700	46300	12400	5000	2600	1400	800	28030
1929	300	4900	12400	10000	27000	13400	18000	8400	6600	2700	1600	700	10600
1930	300	300	53900	18700	46400	41700	18200	10100	4400	2500	1600	1100	19920
1931	300	1300	1400	18600	20500	32400	7500	2400	2400	1300	600	300	8900
1932	2100	7800	32100	53000	26500	27400	23500	20700	7100	3400	2000	700	2063
1933	300	800	7400	21800	27600	77700	23100	26200	14000	5300	2700	1100	2080
1934	700	1000	23700	27700	25000	30100	14700	7900	3900	2700	1900	700	1400
1935	1500	25900	16700	57600	27900	63900	91200	17200	6300	3000	2200	1200	3146
1936	1200	1200	10400	149300	98200	36700	34200	10200	14300	5500	2900	1200	3653
1937	300	300	500	3100	17200	67800	82600	14000	9900	4200	2300	700	2029
1938	1600	78400	82300	44400	201600	213400	61700	28300	13800	5600	3100	1700	7359
1939	1400	4100	24800	15800	36200	44600	9200	6300	3900	2400	1600	700	1510
1940	400	300	22500	83500	177100	117500	51600	12400	6100	3700	2600	1600	4793
1941	1200	4400	79900	109700	104700	92500	92500	30600	16300	8800	5800	3000	5494
1942	800	3700	101800	69500	148100	22600	54600	40400	28100	10400	6200	2100	4883
1943	800	17900	51900	108500	49300	50400	38200	16300	15600	6200	3700	1600	3604
1944	2000	2000	2700	16300	25500	37200	14600	10000	7200	4000	2500	1000	1250
1945	700	25300	34500	19200	89700	56100	29500	17900	10300	4700	2800	1200	2919
1946	2800	48800	143000	58200	40700	45700	24800	9500	5100	3500	2600	800	3855
1947	300	8700	9300	3000	31400	56700	21700	4200	6500	3000	2200	1000	1480
1948	9800	5500	3600	20900	31400	43900	106600	33500	20500	7500	5000	3100	2913
1949	1800	4300	20800	12700	50300	111700	24100	9800	4500	3100	2000	700	2458
1950	400	1600	2300	34400	53300	87500	35700	14800	6600	3700	2400	1100	2438
1951	31400	26800	101800	98600	117400	40000	20500	17100	7100	3900	2600	2200	4694
1952	4300	14700	88600	58500	147900	78000	79200	32700	14400	7500	4700	3300	5338
1953	2800	3300	47700	179000	52700	48100	45900	39600	28200	11900	6500	4200	4699
1954	4400	10600	15200	108700	115100	81900	64100	18800	11400	5800	3800	3900	4437
1955	4100	15700	29600	25900	22400	19000	22500	24800	7700	4500	2400	2100	1807
1956	2500	9900	180500	194200	119400	84800	47700	32000	12400	6300	3800	3200	6967
1957	5300	5800	5500	10600	42400	65200	31600	30200	10900	4900	3000	2800	2182
1958	15700	24400	52500	104400	335900	102000	110600	32300	17100	8300	5200	3800	8122
1959	3300	4800	6800	79300	78000	63400	26100	10700	6200	3300	2300	2800	2870
1960	2800	2700	4100	12100	87800	59700	19000	16600	9300	4000	2400	1800	2223
TOTAL	148700	615200	1677200	2725200	4038100	2953600	2184300	957500	496000	225600	143700	92600	162577
MEAN	3000	12300	33500	54500	80700	59100	43700	19200	9900	4500	2900	1900	3252
PERCENT	0.9	3.8	10.3	16.8	24.8	18.2	13.4	5.9	3.0	1.4	0.9	0.6	100

TABLE 21

RUNOFF OF SOUTH FORK TRINITY RIVER NEAR SALYER

Location: Lat. 40° 50' 30", Long. 123° 34' 00", in SE 1/4 Sec. 1, T5N, R5E, HB&M, on right bank 4 miles south of Salyer and 8 miles upstream from mouth.
Drainage area: 899 square miles.
Records available: October 1911 to September 1913, October 1950 to date.
Recorded extremes: Maximum discharge 65,100 cfs (December 22, 1955); minimum discharge, 54 cfs (September 10, 1955).
Remarks: Records good except those for periods of no gage-height record, which are fair.

Recorded flows at this station were adjusted to full natural flows by adding estimated depletions for irrigation.

Seasonal flow estimates for 1910-11 and 1913-14 to 1950 were obtained by a correlation to the stream gaging station Eel River at Scotia. The data from this correlation are:

$Y = -2.0 + 0.2118\ X$

Y = S. F. Trinity River near Salyer in 1,000 acre-feet

X = Eel River at Scotia in 1,000 acre-feet

$\bar{r}$ = correlation coefficient = 0.9945

$\bar{S}y$ = standard error of estimate = 59

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method using the Eel River at Scotia gaging station as the base station. In balancing the monthly flows at this station and the gages near Hoopa and near Burnt Ranch, the monthly distribution of flows at this station were adjusted to eliminate illogical accretions.

TABLE 21 (Continued)

Monthly and seasonal unimpaired flows at this station are tabulated on the following page.

TABLE 21 (CONTINUED)

RUNOFF OF SOUTH FORK TRINITY RIVER NEAR SALYER

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F44170
LOCATION LAT 40-50-30N, LONG 123-34-00W
SE1/4 SEC. 1, T5N, R5E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 899 SQ. MILES

Y R	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
11	2000	6000	19000	198000	174000	177000	145000	85000	56000	15000	8000	4000	889000
12	1000	3000	5000	132000	93000	154000	83000	185000	54000	21000	11000	22000	764000
13	5000	153000	123000	296000	107000	107000	196000	72000	37000	20000	10000	4000	1130000
14	1000	21000	135000	777000	289000	161000	228000	146000	43000	18000	13000	8000	1840000
15	36900	31000	59100	194000	650000	315000	252000	116000	56000	21000	14000	10000	1755000
16	12100	25900	157000	145000	522000	280000	224000	103000	49000	19000	13000	9000	1559000
17	1000	8000	55000	42000	211000	239000	213000	80000	37000	14000	8000	4000	912000
18	1000	4000	26000	22000	136000	155000	93000	22000	10000	4000	3000	3000	479000
19	1000	11000	26000	204000	357000	195000	233000	54000	19000	10000	6000	3000	1119000
20	1000	2000	27000	7000	4000	72000	87000	77000	10000	7000	2000	2000	298000
21	7000	235000	243000	461000	302000	205000	86000	64000	27000	11000	8000	4000	1653000
22	1000	7000	91800	96700	115500	160000	182000	82000	33000	10000	6000	3000	788000
23	3000	12000	86000	149000	73000	35000	154000	32000	19000	10000	5000	3000	581000
24	3000	2000	13000	28000	98000	15000	12000	6000	2000	1000	1000	1000	182000
25	14000	103000	125000	77000	572000	107000	301000	130000	55000	17000	9000	7000	1517000
26	2000	9000	38000	58000	391000	68000	74000	32000	10000	5000	3000	2000	692000
27	4000	177000	161000	199000	590000	210000	208000	60000	30000	14000	7000	3000	1663000
28	1000	59000	49000	121000	136000	356000	168000	51000	19000	9000	4000	2000	975000
29	1000	19000	50000	39000	94000	48000	70000	37000	27000	10000	5000	2000	402000
30	1000	1000	214000	72000	160000	147000	70000	44000	18000	9000	5000	3000	744000
31	1000	5000	6000	75000	74000	119000	30000	11000	10000	5000	2000	1000	339000
32	6000	29000	124000	198000	89000	94000	88000	88000	28000	12000	6000	2000	764000
33	1000	3000	29000	83000	94000	272000	88000	113000	56000	19000	8000	3000	769000
34	2000	4000	95000	108000	87000	107000	57000	35000	16000	10000	6000	2000	529000
35	4000	89000	60000	201000	87000	204000	318000	68000	23000	10000	6000	3000	1073000
36	3000	4000	37000	515000	303000	116000	118000	40000	52000	18000	8000	3000	1217000
37	1000	1000	2000	12000	59000	238000	316000	61000	40000	15000	7000	2000	754000
38	4000	251000	275000	144000	585000	634000	200000	104000	47000	17000	8000	4000	2273000
39	4000	16000	100000	62000	127000	160000	36000	28000	16000	9000	5000	2000	565000
40	1000	1000	79000	285000	540000	367000	176000	48000	22000	12000	7000	4000	1542000
41	3000	14000	268000	357000	305000	276000	301000	113000	56000	27000	15000	7000	1742000
42	2000	12000	344000	228000	434000	68000	179000	150000	97000	32000	16000	5000	1567000
43	2000	60000	182000	369000	150000	157000	130000	63000	56000	20000	10000	4000	1203000
44	6000	8000	11000	65000	91000	136000	58000	45000	30000	15000	8000	3000	476000
45	2000	90000	128000	69000	289000	185000	106000	73000	39000	16000	8000	3000	1008000
46	7000	161000	493000	195000	122000	140000	83000	36000	18000	11000	7000	2000	1275000
47	1000	34000	38000	12000	111000	205000	86000	19000	27000	11000	7000	3000	554000
48	26000	19000	13000	73800	99200	142000	376000	134000	76000	25000	14000	8000	1006000
49	5000	16000	81000	48000	170000	386000	91000	42000	18000	11000	6000	2000	876000
50	1000	6000	9000	129000	179000	301000	134000	63000	26000	13000	7000	3000	871000
51	80300	89500	355600	334600	356100	124200	69300	65800	25500	12600	7000	5300	1525800
52	11000	49100	309200	198300	447900	242100	268100	125600	51400	23900	12500	8100	1747200
53	7000	10900	163200	595600	156700	146400	152300	149100	98600	37400	17000	10100	1544300
54	11200	55700	76700	374400	343000	244800	198900	59400	32900	16300	11400	9700	1434400
55	9900	41100	100400	98600	77600	69300	83200	98700	31400	14800	6800	5100	636900
56	5800	39600	577800	584000	319800	232300	145200	108400	43600	18400	7100	6500	2088500
57	15000	19400	18100	44100	159200	262000	117000	118000	39500	17000	7500	6900	823700
58	49600	109100	205300	372200	884400	281900	313300	109800	51000	21600	12400	8500	2419100
59	7600	13900	21100	270000	250700	181500	104100	45000	23300	12200	7500	8200	945100
60	7500	6900	11500	39700	285900	237100	96600	84900	45300	15100	8600	5700	844800
TAL	385900	2147100	5915800	9458000	12351000	9534600	7598000	3776700	1806500	742300	399800	239100	54354800
AN	7700	42900	118300	189200	247100	190700	152000	75500	36100	14800	8000	4800	1087100
RCENT	0.7	3.9	10.9	17.4	22.9	17.5	14.0	6.9	3.3	1.4	0.7	0.4	100.0

TABLE 22

RUNOFF OF TRINITY RIVER NEAR HOOPA

Location: Lat. 41° 01' 50", Long. 123° 39' 05", in SE 1/4 Sec. 31, T8N, R5E, HB&M, in Hoopa Indian Reservation, on left bank 0.7 mile downstream from Campbell Creek and 1-3/4 miles southeast of Hoopa.
Drainage area: 2,848 square miles.
Records available: October 1911 to January 1914, October 1916 to September 1918, October 1931 to date.
Recorded extremes: Maximum discharge, 190,000 cfs (December 22, 1955), minimum discharge, 162 cfs (October 4, 1931)
Remarks: Records good. Flow regulated by Trinity Lake beginning in November 1960 (usable capacity 2,160,000 acre-feet). Small diversions above station for mining and irrigation.

Recorded flows at this station were adjusted to full natural flows by adding estimated depletions for mining and irrigation.

Seasonal flow estimates necessary to extend the record "near Hoopa" to the full period 1910-11 to 1960-61 were obtained by a correlation to the stream gaging station Trinity River at Lewiston. The data from this correlation are:

$$\log Y = 0.62234 + \log X$$

Y = flow of Trinity River near Hoopa in 1,000 acre-feet

X = flow of Trinity River at Lewiston in 1,000 acre-feet

$\bar{r}$ = correlation coefficient = 0.9681

$\bar{S}y$ = standard error of estimate = 452

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method using the Trinity River at Lewiston gaging station as a base station.

TABLE 22 (Continued)

Monthly and seasonal unimpaired flows for this station are tabulated on the following two pages.

TABLE 22 (CONTINUED)

RUNOFF OF TRINITY RIVER NEAR HOOPA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F41090
LOCATION LAT 41-01-50N, LONG 123-39-05W
SE1/4 SEC. 31, T8N, R5E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 2848 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT[illegible]
1911	47700	129500	291700	502600	664200	1271500	893300	783600	419100	120900	41800	34300	52002[illegible]
1912	33400	44700	45300	477900	502800	388000	357600	850800	401600	125500	54300	76900	33588[illegible]
1913	52800	336000	342000	465900	465800	419000	632600	568800	279600	117600	53600	34800	37685[illegible]
1914	28200	103000	291200	1598900	939500	1235600	930000	802000	426800	168200	47100	36400	66069[illegible]
1915	92700	70300	123400	381600	1356500	1454500	1162000	987600	879200	362100	90500	41900	70023[illegible]
1916	32500	63100	348000	308300	1162000	1269600	655800	480800	356600	178300	51100	32500	49386[illegible]
1917	32100	66900	115000	102800	478800	528900	513600	617800	318600	92600	35900	27500	29305[illegible]
1918	35800	77700	187000	184800	316800	488900	426600	210800	94100	32300	21800	38300	21149[illegible]
1919	48800	80300	110100	472400	697800	579000	823200	662400	201800	68900	27600	25200	37975[illegible]
1920	30400	37300	162800	158600	107500	183200	262700	263200	105200	39100	16500	17000	13835[illegible]
1921	34200	588600	546500	981700	750900	1080100	593100	638400	436700	137800	46000	26800	58608[illegible]
1922	36100	82600	190700	193900	239600	345600	469400	660700	283400	66000	28400	17800	26142[illegible]
1923	52500	74000	180600	300700	222900	352200	474300	368200	145500	67100	29700	27500	22952[illegible]
1924	42000	42600	77600	102700	330800	114900	102900	54300	15900	9600	9600	8900	9118[illegible]
1925	46600	318200	302200	384800	1304800	631600	870200	599600	266200	96700	38300	57300	49165[illegible]
1926	39800	63300	193800	142400	742000	519900	666700	202000	63000	26500	16500	16300	26922[illegible]
1927	35800	571600	951900	734400	1093600	757300	638700	579500	389800	128100	47000	31300	59590[illegible]
1928	33500	251700	193500	436800	587500	871100	498100	424500	109100	49200	24800	21400	35012[illegible]
1929	29000	85800	127700	175200	229600	352000	221600	334200	141000	45700	21300	15200	17783[illegible]
1930	20100	23300	647200	208400	511700	551600	385900	204400	89900	35000	19100	18600	27152[illegible]
1931	22100	35700	70900	189100	194700	334700	229500	142000	91900	27100	13500	12200	13634[illegible]
1932	29900	71100	205000	322900	249800	621800	420600	483700	206500	63300	25000	15700	27153[illegible]
1933	17400	39900	86500	130900	163800	695900	563600	502700	417500	117500	37000	25500	27982[illegible]
1934	24000	33300	183000	392900	268800	385900	297600	186700	85600	34700	18200	15200	19259[illegible]
1935	37400	305600	226700	392300	447600	414100	825300	511000	184300	65000	28200	22900	34604[illegible]
1936	36000	48000	108800	1055900	685300	504200	464700	368300	229100	89300	34100	23800	36475[illegible]
1937	21300	24100	33700	40700	136000	589200	875600	663300	342800	100400	33700	22000	28828[illegible]
1938	47900	571600	850500	568000	1077900	1622900	1151600	1029700	468400	145100	55100	35300	7624[illegible]
1939	59600	116800	287600	167300	262100	575100	347700	196900	92400	39900	19000	16500	2180[illegible]
1940	22800	23200	250400	784200	1294900	1292000	759500	413800	192600	63100	30800	33000	5160[illegible]
1941	52100	89000	788100	1081000	965300	1031000	905900	858200	532000	265600	86700	57000	6711[illegible]
1942	48000	88300	969200	762400	1096000	326200	488900	631500	447300	152500	58800	38600	5107[illegible]
1943	37800	226400	685700	931000	679800	587800	579700	373900	216900	94900	45800	30400	4490[illegible]
1944	55500	89400	80200	179300	276100	354800	286600	364100	199200	74600	34200	23900	2017[illegible]
1945	25200	224500	360400	340700	883500	419100	530500	496000	226900	81100	34900	25400	3648[illegible]
1946	60600	369500	1176200	848900	355600	550400	547700	515200	223000	97200	39100	26600	4810[illegible]0
1947	33900	143700	164500	90500	340000	546100	383100	217400	167500	51100	29100	22500	2189[illegible]0
1948	117900	95400	77100	566800	213300	288600	814000	640100	444300	132300	51400	40800	3482[illegible]0
1949	51900	85100	227800	131500	302200	958500	683200	503200	201700	65600	34400	25700	3270[illegible]0
1950	31200	49800	56500	336000	470600	809300	625600	474300	211500	74400	32900	27600	3199[illegible]0
1951	334000	426400	1099200	850900	1162100	484600	485500	462600	180600	69100	38200	30200	5623[illegible]0
1952	61200	195300	927100	575000	1291200	793400	1051700	839700	403900	189200	66300	37600	6431[illegible]0
1953	33400	45300	401100	1795300	581400	511600	649400	700000	591000	253900	86800	52300	5701[illegible]0
1954	57500	299600	326200	887800	1063200	866400	867500	500800	219900	100400	53900	46300	5289[illegible]0
1955	44500	173200	298300	294000	248100	235900	295000	489300	201500	67200	30700	26200	2403[illegible]0
1956	29700	151700	1726500	1854400	842600	689000	633800	633900	358500	136500	56500	35600	7148[illegible]0
1957	65200	99900	114300	151900	538600	934800	504600	617200	275900	97300	39500	37300	3476[illegible]0
1958	266500	380600	634800	1048500	2799400	901800	1082000	955400	529000	193300	78700	43300	8913[illegible]0
1959	36500	75100	84200	848900	696200	578200	528900	313700	171700	62800	33000	38200	3467[illegible]0
1960	36600	33000	45400	121900	779500	745500	436800	477000	337100	84000	37000	25800	3159[illegible]0
TOTAL	2601600	7721000	17974100	26055700	33070700	33043300	29894400	25855200	13873600	5055600	1983400	1519300	198647[illegible]0
MEAN	52000	154400	359500	521100	661400	660900	597900	517100	277500	101100	39700	30400	3973[illegible]0
PERCENT	1.3	3.9	9.0	13.1	16.8	16.6	15.0	13.0	7.0	2.5	1.0	0.8	10[illegible]0

TABLE 23

ESTIMATED MEAN MONTHLY DISTRIBUTION OF NATURAL RUNOFF
FROM TRINITY RIVER HYDROGRAPHIC UNIT

50-YEAR MEAN PERIOD, 1910-60

Subunit and Related Gaging Stations		October		November		December		January		February		March		April		May		June		July		August		September		Total
Ref. No.	Name	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Acre-feet
F-4A	Trinity Reservoir	1.6	18,900	3.7	44,100	6.4	76,800	8.1	96,200	11.9	141,700	13.8	165,200	18.3	219,600	20.3	242,600	10.7	128,000	3.2	38,700	1.1	13,500	0.9	10,300	1,195,600
F-4 1640	Trinity River at Lewiston (gage)		19,100		44,500		77,500		97,100		143,100		166,700		221,700		245,100		129,200		39,100		13,600		10,400	1,207,100
F-4B	Weaver Creek	1.2	500	3.8	1,600	8.0	3,400	10.6	4,500	19.4	8,200	19.6	8,300	14.2	6,000	12.0	5,100	6.8	2,900	2.6	1,100	0.9	400	0.9	400	42,400
F-4C	Middle Trinity	1.1	2,100	3.7	6,800	8.1	14,800	10.5	19,200	19.4	35,600	19.6	35,900	14.2	25,900	12.1	22,300	6.8	12,500	2.5	4,600	1.0	1,900	1.0	1,800	183,400
	Subtotal: All preceding subunits		21,500		52,500		95,000		119,900		185,500		209,400		251,500		270,000		143,400		44,400		15,800		12,500	1,421,400
F-4 1480	Trinity River near Douglas City (gage)		21,500		52,500		95,000		119,900		185,500		209,400		251,500		270,000		143,400		44,400		15,800		12,500	1,421,400
F-4D	Helena	1.0	4,300	5.2	22,500	6.8	29,500	10.2	44,400	17.0	74,200	17.6	76,300	16.8	72,900	13.2	57,300	7.6	32,200	2.9	12,700	1.0	4,500	0.7	3,000	433,800
F-4E	New River	2.2	9,200	3.5	14,700	10.2	42,400	15.0	62,400	14.9	62,000	19.8	82,500	10.7	44,700	13.0	54,200	6.1	25,600	2.5	10,400	1.2	5,200	0.9	3,900	417,200
F-4F	Burnt Ranch	1.5	4,100	2.5	6,800	11.9	32,200	19.6	53,000	15.5	41,800	11.0	29,700	14.3	38,500	8.7	23,500	8.4	22,600	4.4	12,000	0.9	2,400	1.3	3,600	270,200
	Subtotal: All preceding subunits		39,100		96,500		199,100		279,700		363,500		397,900		407,600		405,000		223,800		79,500		27,900		23,000	2,542,600
F-4O	Hayfork Valley	0.9	2,300	3.8	9,300	10.3	25,400	16.8	41,200	24.9	61,000	18.2	44,700	13.3	33,100	5.9	14,500	3.0	7,500	1.4	3,400	0.9	2,200	0.6	1,400	246,000
F-4H	Hayfork Creek	0.9	700	3.8	3,000	10.3	8,200	16.8	13,300	24.9	19,700	18.2	14,400	13.3	10,600	5.9	4,600	3.0	2,400	1.4	1,100	0.9	700	0.6	500	79,200
	Subtotal: Hayfork Valley and Hayfork Creek subunits		3,000		12,300		33,500		54,500		80,800		59,100		43,700		19,100		9,900		4,500		2,900		1,900	325,200
F-4 4400	Hayfork Creek near Hyampom (gage)		3,000		12,300		33,500		54,500		80,800		59,100		43,700		19,100		9,900		4,500		2,900		1,900	325,200
F-4J	Upper South Fork	0.7	3,200	3.5	15,900	10.0	45,600	17.8	81,200	24.6	112,200	16.4	74,900	13.9	63,400	7.3	33,500	3.4	15,500	1.3	5,800	0.7	3,100	0.4	1,800	456,100
F-4 4800	South Fork Trinity River near Hyampom (gage)		3,200		15,900		45,600	15.0	81,200		112,200		74,900		63,400		33,500		15,500		5,800		3,100		1,800	456,100
F-4K	Hyampom	0.6	300	3.7	1,900	9.9	5,100	16.4	8,400	25.2	13,000	16.3	8,400	11.6	7,500	7.4	3,800	3.5	1,800	1.4	700	0.6	300	0.4	200	51,400
F-4L	Lower South Fork	0.4	1,300	5.3	15,900	13.3	39,900	16.0	47,900	16.5	49,400	18.7	56,400	15.6	46,800	7.6	22,900	4.1	12,200	1.5	4,500	0.6	1,900	0.4	1,100	300,200
	Subtotal: South Fork Trinity River Basin		7,800		46,000		124,100		192,000		255,400		198,800		161,400		79,300		39,400		15,500		8,200		5,000	1,132,900
	Subtotal: All preceding subunits		46,900		142,500		323,200		471,700		618,900		596,700		569,000		484,300		263,200		95,000		36,100		28,000	3,675,500
F-4M	Willow Creek	0.4	500	5.3	6,000	13.3	15,100	16.0	18,100	16.5	18,600	18.7	21,100	15.6	17,700	7.6	8,600	4.1	4,600	1.5	1,700	0.6	700	0.4	400	113,100
F-4N	Hoopa	2.2	8,600	3.5	13,500	10.2	39,000	15.0	57,200	14.8	56,600	19.7	75,200	10.8	41,100	13.0	49,800	6.1	23,500	2.5	9,500	1.3	4,800	0.9	3,600	382,400
F-4	Total: Trinity River Hydrographic Unit	1.3	56,000	3.9	162,000	9.1	377,400	13.1	547,000	16.7	694,000	16.6	693,000	15.1	627,800	13.0	542,700	7.0	291,300	2.5	106,200	1.0	41,600	0.8	32,000	4,171,000

Ground Water Hydrology

Hoopa Valley

Hoopa Valley is a narrow valley formed by the Trinity River in the northeast part of Humboldt County. It is in the Hoopa Hydrographic Subunit, about 7 miles upstream from the confluence of the Trinity and Klamath Rivers and is about 50 road miles northeast of Eureka. The entire valley is located within the Hoopa Indian Reservation.

The valley is drained by the Trinity River, which traverses the length of the valley and flows in a northwesterly direction. Several perennial tributary streams, including Mill, Supply, Hostler, and Soctish Creeks, in order of decreasing drainage area, enter the valley from the adjacent mountains. Other smaller creeks also flow into the valley, but many are intermittent and all are minor in size.

The valley is about 5 square miles in area, with a length of about 7 miles and a width averaging 0.75 miles. Upstream and downstream from the valley the river flows through narrow, gorge-like canyons, typical of most of the Trinity River. The elevation of the stream channel at the upstream southern end of the valley is about 350 feet, decreasing to about 250 feet where it leaves the northern end of the valley. Prominent terraces border each side of the river throughout the length of the valley. In places, the valley floor is over 200 feet higher in elevation than the river channel, but the average difference in elevation is less than 100 feet. The terraces slope gently upward away from the river and merge with alluvial fans and talus deposits near the edges of the valley. The valley is surrounded by steep ridges and peaks of the Klamath Mountains on the east, and South Fork Mountains on the west.

Surface waters from the Trinity River, perennial tributary streams, and springs along the edge of the valley provide the principal source of water supply to the valley.

Ground water is not utilized to any great extent because of abundance of surface water and undependability of the ground water supply. The existing wells generally have low yields and are used primarily for domestic purposes. The highest yielding well in the valley is located near Supply Creek and reportedly yields about 300 gpm.

Geology. Geologic formations in Hoopa Valley are divided into two distinct groups based on their lithology and water-bearing properties. They are: (1) the bedrock group which consists essentially of nonwater-bearing rocks of pre-Tertiary age, and (2) the unconsolidated, alluvial deposits of Quaternary age, which comprise the principal source of ground water in the valley.

The bedrock group consists of schist, slate, slaty sandstone, and shale of pre-Tertiary age. These rocks form the mountains which surround the valley and also underlie, at shallow depth, the alluvium in the valley. Dark gray to black slates, slaty sandstone, and shales are the most common type of bedrock in the area. These rocks are exposed in the channel of the Trinity River throughout the length of the valley. Except for occasional places in the river where the channel is partly filled with coarse gravel deposits, the river flows directly on these rocks. The bedrock is essentially nonwater-bearing.

The valley floor is underlain by unconsolidated alluvial deposits which have a maximum thickness of about 65 feet along the center of the valley. These deposits consist mostly of terrace deposits bordering each side of the Trinity River throughout the valley, but they also include alluvial fan deposits at the point where the tributary streams enter the valley, and a small amount of talus-slope deposits at the base of the adjacent steep slopes. Terrace deposits, the most important water-bearing unit, are generally well sorted, and consist mostly of gravel up to and including boulders in size, with little finer-grained material. Permiabilities are high in the terrace materials. The alluvial fans and the talus deposits consist of silt, sand, and gravel, and poorly sorted subangular rock fragments derived from the bedrock in the mountains surrounding the valley. Permeabilities in these materials are lower than in the terrace deposits, but they are still moderately high. The alluvial deposits are nowhere continuous across the valley, as the Trinity River has cut down through them and into the underlying bedrock.

Ground Water. Ground water occurs principally in the unconsolidated alluvial deposits under unconfined conditions. In April 1960, depths to the water table averaged about 20 to 30 feet in most of the valley. The water table was highest at the edge of the valley near the tributary streams, and sloped away from them and toward the Trinity River. This is probably characteristic of the water table throughout the year. The tributary streams are influent, creating local ground water mounds beneath their courses, and leaving the alluvium unsaturated in some interstream areas.

Seasonal fluctuations in the water levels are generally rapid and of large magnitude. Water levels were measured by the U. S. Geological Survey in ten wells during April 1960, when the water table was near its maximum elevation. At that time depths to water ranged from 18 to 34 feet and the saturated thickness of water-bearing materials ranged between 9 and 19 feet, with an average of about 15 feet. The greatest saturated thicknesses occur near the influent tributary streams and the least near the Trinity River. Records of well measurements during the dry season are scarce, but the water table lowers considerably, and some of the interstream areas may become nearly devoid of ground water. There are reports of dry wells and inadequate yields during the late summer and fall due to the rapid lowering of levels. Since most of the alluvial deposits are highly permeable, the rate of ground water movement is quite rapid. The ground water tends to move in a relatively thin sheet just above the underlying bedrock, and as a consequence, the saturated thickness of the alluvium is small.

The source of ground water in Hoopa Valley is the direct infiltration of precipitation which falls on the valley floor and the infiltration of runoff derived from the adjacent drainage areas. The Trinity River does not contribute to the ground water reservoir except during very high water stages.

<u>Recharge Potential</u>. The terrace deposits which cover most of the flood of Hoopa Valley are highly pervious, and water

applied on the surface infiltrates rapidly. The alluvial fans and talus deposits on the edge of the valley are less pervious than the terrace deposits, but they still have moderate permeability and also serve as recharge areas. Therefore, the ground water body can be recharged very rapidly, but the ground water is retained for only short periods due to its rapid movement to points of discharge. Relatively high water levels in the valley are found only near perennial tributary streams where the water table is being constantly recharged.

Storage Capacity. The estimated storage capacity of the alluvium for an average depth interval is summarized in the following table:

TABLE 24

GROUND WATER STORAGE CAPACITY IN HOOPA VALLEY

Depth interval (feet)	Area (acres)	Thickness (feet)	Estimated average specific yield (percent)	Storage capacity (acre-feet)
10-40	3,200	30	20	19,200
			Total rounded	19,000

Water levels indicate the alluvium has a saturated thickness of 15 feet near the end of the recharge period. This corresponds to a usable storage at that time of 9,500 acre-feet. However, during the summer and fall, the water table lowers considerably; and in the interstream areas, it may nearly coincide with underlying bedrock. The usable storage at that time is considerably less than 9,500 acre-feet -- probably not more than half that amount. Measurements of water levels during the dry period would be necessary to determine the saturated thickness and the amount in storage. Wells pumping close to the influent streams would induce additional seepage from the streams and increase the amount of available water.

Pumping Costs. Wells located within about 1,000 feet of the perennial streams can probably yield about 200 gpm with a pumping lift of 60 feet. On this basis, the cost to pump irrigation water would be about $9 per acre-foot with a 30 percent use factor.

Yields of wells located farther than about 1,000 feet from the streams probably would not be more than 50 gpm with a lift of 60 feet. Pumping costs for these conditions would be about $20 per acre-foot with a 30 percent use factor. Table 25 presents pumping costs for various use factors. The total annual costs shown in this table were determined by the procedure outlined on page 50.

TABLE 25

APPROXIMATE TOTAL ANNUAL COST
OF PUMPING GROUND WATERS
IN HOOPA VALLEY
(In Dollars Per Acre-Foot)

Distance of well from perennial stream	Use factor 10%	20%	30%	40%
Less than 1,000 feet1/	$20	$12	$ 9	$ 7
More than 1,000 feet2/	--	28	20	15

1/ Based on 200 gpm at a 60-foot pumping lift plus 55 psi operating pressure.
2/ Based on 50 gpm at a 60-foot pumping lift plus 55 psi operating pressure.

Hayfork Valley

Hayfork Valley, located in the Hayfork Valley Hydrographic Subunit, is 40 air miles west of Redding and 16 air miles southwest of Weaverville. It is a narrow valley extending in an east-west direction along Hayfork Creek, and is surrounded by steep ridges of the Klamath Mountains.

The valley is drained by Hayfork Creek, which flows in a westerly direction in its course through the valley. Several intermittent streams, and three perennial streams, Big Creek, Salt Creek, and Tule Creek, enter the valley and flow into Hayfork Creek.

The valley is slightly over 6 miles long, about 3-1/2 miles wide at its widest point, and has an area of about 18 square miles. The upstream elevation of the stream channel at the eastern end of the valley is about 2,400 feet and at the western end is about 2,250 feet. The valley floor ranges in elevation from 2,250 feet to about 2,500 feet. It is nearly flat near the center of the valley and slopes gently upward to low foothills on the north edge of the valley and to the base of steep ridges in the south part of the valley.

Hayfork Creek, throughout its course through the valley, is bordered by Recent alluvium which covers only part of the valley floor. This alluvium forms terraces which are usually only a few feet higher, but occasionally up to 30 feet higher in elevation than the bed of the stream. Consolidated older sediments belonging to the Weaverville formation border the alluvium in most of the valley, and form the low foothills in the north part of the valley.

Surface water from streams in the valley provides nearly all the irrigation water and some of the domestic water supply.

The town of Hayfork obtains its water from Big Creek located east of the town, and outlying farms and ranches obtain water from springs and wells.

Present development of ground water consists of one industrial well and numerous domestic wells. Most of the wells are shallow dug wells 10 to 25 feet deep which provide water for domestic use only. There are no true irrigation wells in the valley. Instead, some water for irrigation is pumped from sumps excavated in or near the channels of the creeks. Present pumpage from true wells is probably less than 300 acre-feet per year.

Geology. Geologic formations in Hayfork Valley are, from older to younger: (1) the bedrock, which includes the Chanchelulla Formation and granitic intrusives, (2) the Weaverville Formation and (3) the Recent alluvium.

Bedrock. Bedrock forms the ridges and peaks which surround Hayfork Valley, and underlies the alluvial deposits of the valley floor. The bedrock is nonwater-bearing, and consists of a granitic intrusive near the western edge of the valley and metamorphic rocks beneath the remainder of the valley. The metamorphic rocks are primarily schist, quartzite, and slates.

Weaverville Formation. The flat valley floor and the low terraced hills on its north side are carved from poorly consolidated stream- and lake-deposited sediments of the Weaverville Formation of Oligocene age, which dip up to 30° to the south and southeast. Along the north and northwest sides of the valley, these sediments are in depositional contact with the underlying bedrock; but along the south side, they are terminated by northeasterly trending faults with large displacement. Other faults cross the deposits in a north to northwest direction. Erosion has removed most of the original deposit, but remnants have been preserved by downfaulting and are exposed in the Hyampom-Hayfork-Weaverville area. In Hayfork Valley, these sediments consist of clayey gravels, sandy silts and shales, lignitic shales, tuffs, and conglomerates. To the northeast in the Lowden-Redding Creek areas, the Weaverville Formation contains lenses of partially cemented to cemented gravels, some of which required blasting in early gold mining operations. This cementing is also present in the Hayfork area, and the material is finer grained overall than that to the northeast. The total thickness of the Weaverville Formation in Hayfork Valley probably exceeds 600 feet. One well penetrated it to a depth of 575 feet.

The Weaverville Formation has negligible potential for the development of irrigation supplies because of its overall low permeability. Well 31/12-14F1, owned by the Trinity Alps Lumber Company, is 575 feet deep and yielded only about 50 gpm. It is now abandoned. Well 31/12-11M1 was drilled to a depth of 282 feet and then abandoned because of insufficient yield.

<u>Alluvium</u>. Part of the valley floor is covered by a thin layer of unconsolidated Recent alluvium. It occurs throughout the valley on both sides of Hayfork Creek, and extends for a short distance up the main tributaries. The alluvium consists of moderately permeable sand, gravel, silt, and clay, usually poorly sorted.

Only two well logs are available for the valley, and the thickness of the alluvium must be estimated. Earlier geologic investigations have variously estimated the maximum thickness of the alluvium between the extremes of 15 and 30 feet. The Weaverville Formation is exposed in several places along the bed of Hayfork Creek, and the maximum observed thickness of the overlying alluvium along the creek is no more than 25 feet. The average thickness of the alluvium is about 10 feet, and the maximum thickness about 25 feet. The alluvium has moderate permeability, but its potential as a source of irrigation supply is limited by its small thickness and low storage capacity. The best well in the valley, 31/12-11N1, located 1,400 feet south of Hayfork Creek, is 16 feet deep and yields up to 200 gpm. It produces from gravels which apparently have good hydraulic continuity with Hayfork Creek and Salt Creek. Other wells located near Hayfork Creek in the western part of the valley could produce similar amounts, but the average yield would probably be less.

Ground Water. The source of ground water in Hayfork Valley is from both the precipitation which falls on the valley floor and percolates downward to the water table, and the runoff from the surrounding mountains which infiltrates through the creek beds into the ground water body. Ground water moves generally toward the center and western part of the valley. The streams appear to be influent throughout most of their courses through the valley. However, in the eastern part, Hayfork Creek flows on the Weaverville Formation, and the Recent alluvium is recharged by the creek only in periods of high flow. In the western part, gravels extend below the streambed and are probably recharged throughout the year.

Ground water occurs under water table conditions in the alluvium. The depth to water varies from about 10 feet near the streams to 35 feet near the valley margins. In the interstream areas, the Recent alluvium and the upper portion of the Weaverville Formation are often devoid of ground water. Water levels in the valley have not been measured over a period of time and the amount of fluctuation is not known, but the level probably declines considerably during the dry season. Domestic wells are subject to rather rapid dewatering at that time.

The Recent alluvium is apparently capable of being recharged quite rapidly, both by infiltration of rainfall and seepage from influent streams. Most of the streams flow on sand and gravel, and the upper portion of the alluvium consists mostly of sand and gravel with moderate permeability. The underlying Weaverville beds have a low permeability, and inflow and outflow of ground water occur at a slow rate.

Storage Capacity. The usable storage capacity has been estimated for the Recent alluvium below a depth of 10 feet. Since few well logs are available, the specific yield was estimated from visual examination of surface exposures. The following table shows the estimated usable storage capacity:

TABLE 26

GROUND WATER STORAGE CAPACITY IN HAYFORK VALLEY

Area (acres)	Thickness (feet)	Estimated specific yield (percent)	Usable storage capacity (acre-feet)
1,000	10	15	1,500

Since the saturated thickness of the Recent alluvium probably does not average more than 5 feet, the usable storage probably does not exceed 700 acre-feet. The Weaverville Formation is considered to have negligible usable storage capacity because of its low permeability and low yield to wells. Domestic and stock wells can be developed in it, but wells with yields of over 50-100 gpm are apparently unobtainable.

Pumping Costs. The cost to pump ground water for irrigation in Hayfork Valley has been estimated based on a well 30 feet deep, yielding 50 gpm. This is the average for wells located in the Recent alluvium in the western part of the valley within about 1,500 feet of Hayfork Creek. Elsewhere, the yields will be lower and the pumping costs higher. Using this average well, the cost to pump ground water for irrigation will be about $12 per acre-foot with a 30 percent use factor. Table 27 shows the relationship of pumping costs versus use factor. The total annual costs shown in this table were determined by the procedure outlined on page 50.

TABLE 27

APPROXIMATE TOTAL ANNUAL COST
OF PUMPING GROUND WATER
IN HAYFORK VALLEY[1/]
(In Dollars Per Acre-Foot)

Use factor (%)	Annual cost
11	$28
20	17
30	12
40	10

1/ Applicable only for wells located within 1,500 feet of Hayfork Creek.

Hyampom Valley

Hyampom Valley, located in the Hyampom Hydrographic Subunit on the South Fork Trinity River, is in west-central Trinity County, 28 air miles southwest of Weaverville. The valley is small, being only 3.5 miles long and 0.6 mile wide. Streams flowing into the valley include Hayfork Creek, Olsen Creek, Pelletreau Creek, and Kerlin Creek. The elevation of the valley floor ranges between 1,200 and 1,300 feet, and steep, rugged mountains up to 3,500 feet in elevation surround the valley.

Present development of ground water consists of numerous shallow domestic wells and at least one industrial well. The total amount of ground water pumped annually is probably less than 100 acre-feet. Water for irrigated lands, presently very limited in extent, is obtained from streams.

The valley was originally formed by erosion of igneous and metamorphic rocks of the Chanchelulla Formation, and then partially filled by Tertiary alluvium of the Weaverville Formation which was deposited under flood plain and shallow lake conditions. Subsequently, faulting and erosion modified the valley, and Recent alluvium was deposited along the flood plains of the streams. The Weaverville Formation now surrounds the Recent alluvium except in the western portion of the valley, and probably underlies it in most of the valley.

The Weaverville Formation is at least several hundred feet thick and consists of consolidated, fine-grained material with interbedded, poorly pervious, partially cemented, dirty gravels. Wells drilled into this formation in Hayfork Valley have met with little success, and the material in Hyampom Valley appears to be no more permeable. The Weaverville Formation has negligible potential for the development of irrigation supplies, although locally it will support low-yielding domestic and stock wells.

The Recent alluvium is at least 50 feet thick in places. It consists of moderately permeable sand and gravels with interbedded lenses of silt and clay. The fine-grained material is partially confining, as water often rises after being encountered in drill holes. Yields of existing wells in the Recent alluvium are low, less than 50 gpm. An industrial well at location 3N/6W-14M1 is pumped at about 25 gpm although it could yield more, and the other wells probably yield less than 25 gpm. However, wells with yields many times greater probably could be developed if they were located on the valley floor in the northwest part of the valley, since gravels in this region are quite thick and extent well below the riverbed. Also, the gravels apparently have good hydraulic continuity with the river, since water levels in a mill pond located about 1,000 feet from the river fluctuate with the river. Elsewhere in the valley, except for areas bordering the streams, well yields are expected to be sufficient only for domestic purposes.

Depths to water range from 12 feet near the river to 20 to 25 feet on the edges of the valley. Present recharge occurs by infiltration of rainfall and seepage from influent streams. The ground water moves generally toward the center of the valley and downstream. The Recent alluvium is capable of recharge at a rapid rate since the gravels extent below the riverbed, and pervious material is exposed over most of the surface of the valley. The Weaverville Formation has no usable storage capacity, and development of high-yielding wells is not possible because of the overall low permeability. The Recent alluvium is estimated to contain over 5,000 acre-feet of usable storage. Considerable seepage from the river could be induced by lowering adjacent water levels.

Weaverville Area

The Weaverville area is located in eastern Trinity County, in the Weaver Creek Hydrographic Subunit, 30 air miles west of Redding. It is a small valley surrounded by steep ridges and mountains. The valley floor is uneven, and ranges in elevation from 1,800 to 2,100 feet. Dredge tailings deposited by early gold mining operations extend along the larger creeks. East and West Weaver Creeks drain the area and join in the southern part of the valley to form Weaver Creek, a tributary to the Trinity River.

Present ground water development consists of domestic wells south of Weaverville. The town obtains its municipal water supply from storage reservoirs constructed on small streams. There are no irrigation wells in the area, and only a very small amount of irrigable land.

The valley is underlain by poorly permeable deposits in the Weaverville Formation consisting of poorly sorted silts, clays, sands, and gravels. The gravels contain considerable fine material and are often cemented. The formation is reportedly about 40 feet thick at Weaverville, and wells in that area encountered water only in the lower few feet of the formation and in the fractured bedrock beneath. Most of the water apparently occurs at the surface of the underlying bedrock. The Weaverville Formation probably does not contribute significant quantities. Well yields are low, generally less than 25 gpm. There is no difficulty reported in locating and developing satisfactory domestic wells.

The area has negligible potential for the development of irrigation wells. The Weaverville Formation is considered to have no usable storage capacity for purposes other than domestic.

Lewiston Area

The Lewiston area, in the Middle Trinity Hydrographic Sub-unit, is located on the Trinity River in eastern Trinity County, 7 air miles southeast of Weaverville. The area contains less than 1 square mile of irrigable land, much of which has been used for urban development since the start of nearby Trinity Dam. Elevation of the area is about 2,000 feet.

Present development of ground water consists of shallow domestic wells. The town of Lewiston pumps its water supply from the river, and other domestic supplies have been developed from small tributary streams. There are no irrigation wells in the valley. Thick gravels occur in the channel of the river, but the irrigable land is more than 100 feet above the river and is underlain by fine-grained material with thin layers of silty gravel deposited by small tributary streams. Well yields are small, with the highest known yield being about 200 gpm. There is apparently no potential for the development of high-capacity irrigation wells in this area.

Lowden Ranch Area

The Lowden Ranch area, in the Middle Trinity Hydrographic Subunit, is located along the Trinity River about 3 miles downstream from the Lewiston area. It contains several hundred acres of flat, irrigated pasture land. The source of the water for irrigation is Grass Valley Creek, a tributary of the Trinity River. Dredge tailings are present near the river, and gravels may underlie the entire flat area. If so, wells with yields of several hundred gpm could probably be developed, but pumping from the river may be more economical. Present development of ground water is not known, but the area has some potential for irrigation wells.

Willow Creek Area

The Willow Creek area, in the Willow Creek Hydrographic Subunit, is located in eastern Humboldt County, 30 air miles northeast of Eureka, at the point where Willow Creek flows into the Trinity River. Terraces on both sides of the Trinity River underlie the only potentially irrigable land in the area, much of which is covered with dense vegetation. Parts of the terraces are more than 100 feet higher in elevation than the river.

Present development of ground water consists of domestic wells. There are no known irrigation or industrial wells in the area. One sawmill and several homes obtain water from the river, and the town of Willow Creek obtains water from a spring.

Terrace materials, up to about 80 feet thick, contain essentially all the ground water in the area. The material consists of poorly sorted clay, silt, sand, and gravel having low permeability. Well yields are usually less than 50 gpm. The terraces are not continuous across the river, as the river has cut down through them into the underlying bedrock. Consequently, the river cannot recharge most of the deposits except in periods of very high flow. Recharge normally occurs by infiltration of rainfall, and by seepage from minor streams. Since the terraces are narrow, the ground water does not have far to move before being discharged, and the terraces do not store much ground water. There are insufficient well data to determine the saturated thickness and storage capacity, but the amount of water in storage is low. Also, pumping costs will be high for irrigation wells. Based on a well pumping 50 gpm, the amount considered to be about the average yield for wells in the area, the cost of pumping would be about $17 per acre-foot with a 30 percent use factor.

Water Quality

Mineral characteristics of surface and ground waters in those subunits of the Trinity River Hydrographic Unit from which data were collected are presented in Table 28. These characteristics indicate in general that surface waters of this hydrographic unit are a soft, calcium-magnesium bicarbonate type, and contain low concentrations of total dissolved minerals and boron. The general character of ground waters, being represented by data collected only in the Hayfork Valley Subunit, is nearly the same as adjacent surface waters, containing about twice the total mineral concentration.

An appraisal of the mineral characteristics of these waters indicates that they are suitable for all intended beneficial uses. In the surface waters, no potential water quality problems have been observed. While no existing ground water quality problems were found, there are indications that a highly mineralized water, possibly of an ancient marine origin, underlies the fresh ground water of the Hayfork Valley Subunit. This underlying water could cause, under certain conditions of aquifer development, a significant mineral degradation of the present excellent quality of water in the upper portions of the aquifer.

TABLE 28

WATER QUALITY CHARACTERISTICS

TRINITY RIVER HYDROGRAPHIC UNIT

Hydrographic subunits	Mineral classification	Range of dissolved mineral concentrations		
		Electrical conductivity (micromhos)	Hardness (ppm)	Boron (ppm)
SURFACE WATERS				
Trinity Reservoir	Magnesium bicarbonate	63-198	27-84	0.00-0.23
Middle Trinity	Calcium bicarbonate	122-391	50-165	0.00-0.26
Weaver Creek	Calcium bicarbonate	92-254	40-125	0.01-0.20
Helena	Calcium bicarbonate	56-123	23-56	0.01-0.08
Burnt Ranch	Calcium-magnesium bicarbonate	65-214	30-100	0.00-0.15
New River	Calcium bicarbonate	191-212	94-104	0.02-0.04
Upper South Fork	Calcium bicarbonate	98-232	45-106	0.00-0.20
Hayfork Valley	Calcium bicarbonate	149-483	69-162	0.00-0.23
Hayfork Creek	Calcium bicarbonate	224-315	110-136	0.00-0.04
Hyampom	Calcium bicarbonate	98-315	45-136	0.00-0.20
Lower South Fork	Calcium bicarbonate	137-336	63-126	0.00-0.12
Willow Creek	Magnesium bicarbonate	241	129	0.05
Hoopa	Calcium bicarbonate	90-243	44-120	0.00-0.20
GROUND WATERS				
Hayfork Valley	Calcium-magnesium bicarbonate	109-843	46-184	0.02-0.39

MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

Surface Water Hydrology

General Description of Unit

The Mad River-Redwood Creek Hydrographic Unit includes the watersheds of the Mad River, Redwood Creek, Little River, and minor coastal streams between the mouth of the Mad River on the south and the Humboldt-Del Norte County line on the north.

The most serious water problem in the unit is the periodic occurrence of damaging floods. Major floods occurred in 1915, 1939, 1950, 1953, and 1955. Flood damage prior to 1945 was primarily to agricultural developments and livestock; however, the encroachment of urban and industrial development into the flood plains of the unit in recent years has seriously increased the potential for flood damage. The U. S. Corps of Engineers is presently engaged in construction of a flood control project on Redwood Creek at Orick.

In contrast to the problem of too much water during the winter rainy season, the unit also has the problem of inadequate streamflow during the summer months to sustain the potential ultimate development of fishery and recreational resources. This problem has been alleviated to some extent on the Mad River by the construction of Ruth Dam in 1961, but other streams of the unit are at present uncontrolled. Irrigation diversions, which tend to decrease the low summer flows, were considered to be of marginal significance and were disregarded in computations for this report.

Precipitation

Precipitation in the Mad River-Redwood Creek Hydrographic Unit averages about 70 inches annually, occurring mostly as low intensity winter and spring rains. At higher inland elevations a large portion of the precipitation occurs as snow. Precipitation varies considerably, both annually and geographically. For example, historical annual precipitation at Ruth has ranged from 23.38 to 82.46 inches; at Big Lagoon from 50.10 to 81.61 inches; and at Crannell from 29.69 to 77.51 inches. Typically, the seasonal precipitation begins in late September or October, reaches a maximum in December, January, or February, and ends in May or early June. Precipitation in late June, July, August, and early September is infrequent and generally insignificant. This seasonal distribution of precipitation is the primary cause of the water problems discussed in the preceding section.

Runoff

Mean annual runoff from the Mad River-Redwood Creek Hydrographic Unit is about 2,069,000 acre-feet, which is equivalent to a depth of about 42 inches over the 931-square mile area of the unit. Due to the topography and geology of the unit, streamflow is highly responsive to rainfall and the pattern of runoff follows closely the seasonal distribution of precipitation. The major part of the unit is made up of long, steep ridges separated by narrow valleys. The valleys, except in the area near the coast, are almost completely barren of alluvial fill which would act as a natural regulating reservoir. These features tend to cause rapid concentration and runoff into the major streams. Concentration of tributary inflow, however, is delayed by the long, narrow drainage basins of both Redwood Creek and the Mad River, tending to increase the duration of flood flows and decrease peak discharges.

The variation of surface runoff in this unit is well illustrated by streamflow records of the gaging station on the Mad River at Arcata, which is discussed on the following pages.

Water Development

Surface water development within the Mad River-Redwood Creek Hydrographic Unit controls only a minor portion of the unit's streamflow. The total storage capacity of reservoirs within the unit is about 56,300 acre-feet, as derived from the following sources: files of the State Water Rights Board, diversion data collected in 1958 for Bulletin No. 94-7, "Land and Water Use in the Mad River-Redwood Creek Hydrographic Unit," and Department of Water Resources Bulletin No. 17, "Dams Within Jurisdiction of the State of California." Storage capacity is about 2.7 percent of the estimated mean seasonal streamflow. It should be noted that the major portion of this storage capacity is provided by Ruth Dam, which was completed in 1961. The total surface storage within the unit at the end of the 1911-60 study period was approximately 4,500 acre-feet, or about 0.2 percent of the estimated mean seasonal runoff. Dams within the unit that are under the jurisdiction of the State, as listed in Bulletin No. 17, are as follows:

Name of dam and owner	Stream	Location	Year completed	Storage capacity, acre-feet
Big Lagoon (Hammond Lumber Co.)	Big Lagoon	Sec. 19, T9N, R1E, HB&M	1947	780
Ruth (Humboldt Bay MWD)	Mad River	Sec. 19, T1S, R7E, HB&M	1961	51,800
Sweasey (City of Eureka)	Mad River	Sec. 16, T5N, R2E, HB&M	1938	3,400

The city of Eureka began obtaining its water supply from the Mad River in 1933, and constructed Sweasey Dam in 1938. Since the city is located in the Eel River Hydrographic Unit, this diversion constituted an export of water from the Mad River Basin. The amount diverted averaged about 3,300 acre-feet per year for the eight-year period from 1953 through 1960. It should be noted that Sweasey Dam functioned as a diversion structure and did not regulate the Mad River. The reservoir has been completely filled with sediment for many years, and the river flows unchecked over the spillway. This is the only development that has had a significant effect on the surface water hydrology of the unit during the 50-year study period, 1910-11 through 1959-60. Sweasey Dam is presently (1964) being phased out and the city of Eureka is getting its water supply from Ranney collectors on the Mad River near Essex, about 10 miles downstream from Sweasey Dam.

Stream Gaging Stations and Records

All streamflow gaging stations in the Mad River-Redwood Creek Hydrographic Unit have short records, the longest being 13 years for the Mad River gaging station near Arcata. However, since the available records correlate well with nearby long term stations, these records are considered adequate to estimate the natural flow of streams within the unit. Table 29 lists all gaging stations within the unit, as shown in the department's "Index of Gaging Stations in and Adjacent to California." The location of stations utilized in preparing this report are shown on Plate 1.

TABLE 29

STREAM GAGING STATIONS IN THE MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

USGS station number	DWR Ref. No.	Station	Drainage area in sq. miles	Period of record
*11-4805.00	F51200	Mad River near Forest Glen	144	1953-date
11-4808.00	F52100	North Fork Mad River near Korbel	40.5	1957-date
*11-4810.00	F51100	Mad River near Arcata	485	1910-1913, 1950-date
*11-4812.00	F50100	Little River at Crannel	40.3	1955-date
*11-4815.00	F55400	Redwood Creek near Blue Lake	67.5	1953-1958
11-4820.00	F55300	Redwood Creek near Korbel	82.8	1911-1913
*11-4825.00	F55100	Redwood Creek at Orick	278	1911-1913, 1953-date

*Stations for which unimpaired flows are tabulated in this report.

Streamflow Estimates

Estimates of monthly and annual natural flows for the 50-year period from 1910-11 through 1959-60 were compiled for all gaging stations within the Mad River-Redwood Creek Hydrographic Unit for which five or more years of records were available. A brief description of the methods used for individual gaging stations is included with Tables 31 through 35. Detailed data on correlations used, other correlations attempted, adjustment factors, etc., are available in the files of the North Coastal Area Investigation.

Mean seasonal full natural flows for the 50-year period from 1910-11 through 1959-60 for the gaging stations, intermediate areas between gages, and ungaged areas within the unit are summarized in Table 30.

Estimated mean monthly distribution of natural runoff from the Mad River-Redwood Creek Hydrographic Unit by subunits and pertinent gaging stations is presented in Table 36.

TABLE 30

SUMMARY OF MEAN SEASONAL FULL NATURAL FLOWS IN THE MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT FOR THE 50-YEAR PERIOD FROM 1910-11 THROUGH 1959-60

Gaging station or intermediate area	Mean full natural flow (in acre-feet)	
Mad River near Forest Glen (gage)	215,700	
Forest Glen to Arcata	782,900	
Mad River near Arcata	998,600	
Arcata to Mouth	31,700	
Subtotal, Mad River Watershed		1,030,300
Little River at Crannel	93,600	
Crannel to Mouth	10,100	
Subtotal, Little River Subunit		103,700
Subtotal, Big Lagoon Subunit		197,500
Redwood Creek near Blue Lake	172,300	
Blue Lake to Orick	530,200	
Redwood Creek at Orick	702,500	
Orick to Mouth	34,800	
Subtotal, Redwood Creek Watershed		737,300
Unit Total		2,068,800

TABLE 31

RUNOFF OF MAD RIVER NEAR FOREST GLENN

Location: Lat. 40° 27' 30", Long. 123° 30' 35", in SW 1/4 Sec. 16, T1N, R6E, HB&M, on right bank 0.7 mile downstream from Lamb Creek and 7.0 miles northwest of Forest Glen.
Drainage area: 144 square miles.
Records available: June 1953 to date.
Recorded extremes: Maximum discharge, 39,200 cfs (December 22, 1955); Minimum discharge, 0.4 cfs (September 15, 1961)
Remarks: Flow regulated by Ruth Reservoir beginning in July 1961 (usable capacity 42,000 acre-feet). No diversion above station.

Streamflow at this station was unregulated during the 50-year study period, so the recorded flows were taken as full natural flows.

Estimates of seasonal natural flows for 1907-08 through 1952-53 were obtained by a least squares correlation, utilizing data processing program 3020.80.1. Data from this correlation are:

$$Y = -2,280 + 0.0422\ X$$

Y = seasonal full natural flow, Mad River near Forest Glen

X = seasonal full natural flow, Eel River at Scotia

$\bar{r}$ = correlation coefficient = 0.9888

$\bar{S}y$ = standard error of estimate = 20,400 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Scotia was used as the base station.

TABLE 31 (Continued)

Monthly and seasonal full natural flows at this station for the 50-year period from 1910-11 through 1960-61 are tabulated on the following page.

TABLE 31 (CONTINUED)

RUNOFF OF MAD RIVER NEAR FOREST GLEN

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F51200
LOCATION LAT 40-27-30N, LONG 123-30-35W
SW1/4 SEC. 16, T1N, R6E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 144 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	400	1400	5300	51200	36900	38500	23400	12500	5000	600	200	100	175500
1912	200	700	1500	37500	21800	36700	14700	30200	5300	900	300	800	150600
1913	800	32400	31500	72000	21400	21700	29700	9900	3200	700	200	100	223600
1914	200	4300	46300	169400	55700	31800	33300	19500	3500	700	300	200	365200
1915	900	17800	50900	69600	82300	65300	38700	16400	4800	900	400	300	348300
1916	800	15800	45100	61800	73200	57900	34400	14500	4200	800	300	300	309100
1917	200	1900	15100	20200	57800	33500	35100	12100	3300	600	200	100	180100
1918	200	1000	6800	5500	28400	32700	14600	3200	900	200	100	100	93700
1919	200	2400	6500	49700	71900	61000	19800	7600	1600	400	200	100	221400
1920	200	300	8100	2000	1000	16700	23700	4100	1000	300	100	100	57600
1921	900	59300	85500	63800	56200	38900	12100	8100	2300	400	200	100	327800
1922	200	1600	15000	9300	50200	37500	25400	12300	3000	400	200	100	155200
1923	400	2500	29900	29100	14700	7100	23700	4500	1600	400	100	100	114100
1924	400	500	3300	6400	18200	2900	1700	800	200	0	0	0	34400
1925	3400	22000	34500	20000	122800	23600	48900	19300	5100	700	200	300	300800
1926	400	2000	9800	14200	78900	13900	11300	4400	900	200	100	0	136100
1927	600	37400	41000	48100	117300	42500	31400	8200	2500	500	200	100	329800
1928	200	13000	13100	30500	28100	61100	37000	7300	1700	400	100	100	192600
1929	200	4200	13700	10000	19900	10600	11400	5400	2400	400	100	0	78300
1930	100	100	36700	32000	30700	28900	10200	5800	1500	300	100	100	146500
1931	200	1100	1500	24700	8100	23200	4300	1500	900	200	100	0	65800
1932	900	6000	44200	35200	17500	18800	13100	11900	2200	400	200	100	150500
1933	100	600	8300	22200	20700	61400	14700	17200	5200	800	200	100	151500
1934	200	800	23600	25200	16800	21100	8300	4700	1300	400	100	100	102600
1935	500	19800	16000	51000	18400	43600	50200	9900	2100	400	100	100	212100
1936	400	700	9200	106000	72900	23300	17500	5300	4300	700	200	100	240600
1937	100	200	800	3500	43600	50000	35900	9600	3900	700	200	100	148600
1938	600	52800	69900	34600	116000	128300	30100	14400	4000	600	200	100	451600
1939	600	3300	24800	14600	24700	31800	5300	3800	1400	300	100	100	110800
1940	100	200	21700	66900	107000	74100	26500	6600	1800	500	200	100	305700
1941	400	2900	69200	87200	61300	56600	45700	15800	4800	1000	400	200	345500
1942	300	2600	90000	56400	88400	14200	27600	21100	8400	1200	400	200	310800
1943	200	12400	45400	86700	29000	31100	19100	8500	4600	700	300	100	238100
1944	1000	1900	3000	17000	19900	30500	9400	6700	2700	600	200	100	93000
1945	200	19600	33600	17200	59000	38600	16300	10400	3400	600	200	100	199200
1946	900	30500	113300	42300	21800	25700	11300	4500	1400	400	200	100	252400
1947	200	7500	10400	3000	23400	44400	13700	2700	2500	400	200	100	108500
1948	4700	4700	4000	46900	15300	34400	57200	22000	7700	1200	400	300	198800
1949	700	3500	21100	11700	34300	79500	14000	6000	1500	400	200	100	173000
1950	200	1300	2500	48400	38300	48400	20800	8900	2200	500	200	100	171800
1951	17600	18800	67400	87300	64400	27300	6700	8200	1600	400	200	200	300100
1952	700	14100	91500	70700	78300	43200	20100	13500	3400	900	200	100	336700
1953	200	1100	61300	123600	15100	43700	20400	22000	10800	1400	500	300	300400
1954	300	16600	19000	115900	64800	46400	39900	4300	2300	600	200	200	310500
1955	300	7100	25500	19700	15800	15500	18300	14200	2400	600	200	100	119700
1956	100	10500	133300	113000	69600	44000	12300	10500	2500	800	200	100	396900
1957	3200	2500	2500	16100	48200	66000	20600	27500	5000	800	300	200	192900
1958	10300	27100	56200	94600	178700	55400	68800	10100	4000	600	500	800	507100
1959	100	800	5500	64900	58100	25500	10400	3300	1200	300	100	400	170600
1960	400	100	500	9600	73900	52300	14100	19500	7000	1000	300	100	178800
TOTAL	56600	491700	1574800	2318400	2490700	1961100	1153100	530700	160500	29200	10600	7900	10785300
MEAN	1100	9800	31500	46400	49800	39200	23100	10600	3200	600	200	200	215700
PERCENT	0.5	4.5	14.6	21.5	23.1	18.2	10.7	4.9	1.5	0.3	0.1	0.1	100.0

TABLE 32

RUNOFF OF MAD RIVER NEAR ARCATA

Location: Lat. 40° 54' 35", Long. 124° 03' 35", in NW 1/4 Sec. 15, T6N, R1E, HB&M, on right bank 100 feet upstream from bridge on U. S. Highway 299, 1.0 mile downstream from Warren Creek, and 2.8 miles northeast of Arcata.
Drainage area: 485 square miles.
Records available: October 1910 to September 1913, August 1950 to date.
Recorded extremes: Maximum discharge, 77,800 cfs (December 22, 1955); Minimum discharge, 16 cfs (September 8,9, 1951, September 11, 1959).
Remarks: Flow regulated by Ruth Reservoir beginning in July 1961 (usable capacity 42,000 acre-feet). Since 1938, approximately 5.4 cfs diverted above station for municipal supply of City of Eureka.

Recorded flows at this station for water years 1910-11 through 1912-13 were taken as full natural flows. Recorded flows for 1950-51 to date were adjusted to full natural flows by adding the City of Eureka diversion of approximately 3,900 acre-feet per year.

Estimates of seasonal natural flows for 1907-08 through 1909-10 and 1913-14 through 1949-50 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$\log Y = 0.58446 + 0.7270 \log X$$

Y = seasonal natural flow, Mad River near Arcata, in 100 acre-feet

X = seasonal natural flow, Eel River at Scotia, in 100 acre-feet

$\bar{r}$ = correlation coefficient = 0.9667

$\bar{S}y$ = standard error of estimate = 33,700 acre-feet

TABLE 32 (Continued)

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Scotia was used as the base station.

Monthly and seasonal full natural flows at this station for the 50-year period from 1910-11 through 1960-61 are tabulated on the following page.

TABLE 32 (CONTINUED)

RUNOFF OF MAD RIVER NEAR ARCATA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F51100
LOCATION LAT 40-54-35N, LONG 124-03-35W
NW1/4 SEC. 15, T6N, R1E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 485 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	6200	11900	24600	208000	168000	135000	129000	81200	16200	5100	2300	1500	789000
1912	1800	7200	16100	231000	188000	130000	91600	141000	24800	7700	3400	7600	850200
1913	4800	159000	202000	265000	98000	103000	142000	53600	14200	7400	3100	2000	1054100
1914	1500	25700	221400	677100	221300	110700	137300	76900	16400	4700	2900	2000	1497900
1915	6700	106100	243200	278400	326900	227600	159800	64600	22300	6200	3300	2500	1447600
1916	6100	97300	223100	255300	299900	208700	146500	59300	20500	5700	3100	2300	1327800
1917	1500	13900	89800	99500	283900	144700	179100	59000	19600	5300	2500	1200	900000
1918	1700	8400	50300	33700	173000	174900	92600	19500	6200	1900	1200	1200	564600
1919	1700	17000	37600	239300	343400	256000	98500	36200	9100	3100	1600	800	1044300
1920	2200	3100	66300	13100	6800	99700	167800	27600	8100	4000	1300	800	400800
1921	6300	330400	382900	238700	209000	127100	46700	30100	9700	2500	1400	900	1385700
1922	1600	12300	93400	48500	258900	170100	136000	63200	18200	3700	2100	1100	809100
1923	4000	19600	190200	154500	78000	33000	129500	23600	10000	3800	1800	1200	649200
1924	5400	5500	31000	50500	144100	20200	14200	6100	1800	700	600	300	280400
1925	25500	133200	167600	81300	495100	83800	204800	77200	24000	5100	2500	2200	1302300
1926	3500	15600	62800	76000	419100	65000	62400	23200	5400	1800	1000	500	736300
1927	4500	220100	193700	189800	459300	146500	127700	32200	11700	3900	1500	800	1391700
1928	1500	93900	76100	147300	135000	257300	184000	34800	9400	3400	1200	600	944500
1929	1700	37500	98000	59800	119200	54900	70200	32000	17000	4400	1700	600	497000
1930	800	1000	226000	164600	156700	129500	53900	29400	8800	3000	1500	1000	776200
1931	2000	10900	12500	169700	55500	139100	29800	10000	6700	2200	900	600	439900
1932	7800	43800	259300	172500	84700	80300	66200	57500	13100	3900	1700	600	791400
1933	800	4600	53100	119300	110600	289000	81200	91500	33000	7800	2700	1400	795000
1934	2500	6400	160800	143100	94500	104900	49100	26000	8500	3700	1800	800	602100
1935	4500	134200	87300	232900	83000	173300	235600	44700	10900	3500	1500	800	1012200
1936	3100	5100	50300	486000	332100	93300	83000	24200	23300	5900	2300	900	1109500
1937	1000	1300	5000	18900	234600	236600	200500	51300	25000	6600	2300	1100	784200
1938	4000	287900	306800	126500	421900	410400	113400	51800	17000	4200	1600	900	1746400
1939	6200	27200	165200	81200	136600	154900	30000	20700	8600	3100	1600	700	636000
1940	800	1400	113700	291900	464000	282400	119200	28300	9400	3500	1700	1100	1317400
1941	3300	17700	333500	352200	245200	199000	189800	62600	22800	7500	3600	1900	1439100
1942	2700	15700	432600	226800	353200	49900	114500	83600	39600	9100	3900	1500	1333100
1943	2000	80900	237300	378900	126200	118600	86100	36900	23500	5800	2800	1200	1100200
1944	10800	17200	21800	103200	119100	160200	59000	40000	19400	6700	3000	1000	561400
1945	1700	133200	183600	78400	267000	153500	76900	46500	18300	5300	2100	1000	967500
1946	6700	181000	539100	168500	86200	89500	46600	18000	6700	2800	1500	700	1147300
1947	1600	63600	70900	17000	132500	220900	80700	15100	16200	4400	2700	1000	626600
1948	40100	32400	22300	219900	71800	141000	276700	101700	42400	10100	4600	3400	966400
1949	6500	26400	129900	60400	174800	356400	74100	30200	9200	3900	2000	700	874500
1950	1500	9400	15500	250400	196800	218700	110800	45500	13800	4700	2100	1600	870800
1951	141900	113000	307300	396700	239500	126500	29400	49100	9900	3600	1900	1400	1420200
1952	9400	83500	346400	244200	365200	164400	106100	53300	15200	7000	2700	1700	1399100
1953	1700	3000	195300	564400	144400	176600	131300	164500	78400	13300	4600	2800	1480300
1954	6900	173000	167400	352800	198300	133800	116000	17400	20600	5800	3300	3000	1198300
1955	3200	26900	189300	149500	68700	63500	102500	62400	11300	4900	2500	2100	686800
1956	2800	64200	574300	495200	260200	136500	54900	42100	13900	5300	2800	2000	1654200
1957	33300	24400	90500	109200	179000	311100	92000	111600	21700	6000	2700	3000	984500
1958	36600	147400	240700	303600	546300	175900	205600	36300	19300	7300	3100	2700	1724800
1959	2400	22800	35900	297300	267200	113800	53500	17500	6600	2700	1600	2100	823400
1960	2700	2200	8600	52700	318500	183000	76900	106600	28300	5900	2500	1800	789700
TOTAL	439500	3079400	8052300	10174700	10961200	7934700	5465000	2517600	866000	249900	114100	76600	49931000
MEAN	8800	61600	161000	203500	219200	158700	109300	50400	17300	5000	2300	1500	998600
PERCENT	0.9	6.2	16.1	20.4	22.0	15.9	10.9	5.0	1.7	0.5	0.2	0.2	100.0

TABLE 33

RUNOFF OF LITTLE RIVER AT CRANNELL

Location: Lat. 41° 00' 40", Long. 124° 04' 50", in NE 1/4 Sec. 8, T7N, R1E, HB&M, on right bank at Crannell, 0.5 mile upstream from Coon Creek and 9.1 miles north of Arcata.
Drainage area: 40.3 square miles. (Revised by Department of Water Resources computation; USGS Water Supply Paper gives area as 44.3 square miles.)
Records available: October 1955 to date.
Recorded extremes: Maximum discharge, 9,300 cfs (March 11, 1957); Minimum discharge, 2.8 cfs (September 9, 1959).
Remarks: No storage or diversion above station.

Streamflow at this station is unregulated, so the recorded flows were taken as full natural flows.

Estimates of seasonal natural flows for 1907-08 through 1954-55 were obtained by a least squares correlation, utilizing data processing program No. 3030.80.1. Data from this correlation are:

$Y = 24,300 + 0.694\ X$

Y = seasonal natural flow, Little River at Crannell

X = seasonal natural flow, Mad River near Arcata

$\bar{r}$ = correlation coefficient = 0.9628

$\bar{S}y$ = standard error estimate = 10,300 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Mad River near Arcata was used as the base station.

Monthly and seasonal full natural flows at this station for the 50-year period from 1910-11 through 1959-60 are tabulated on the following page.

TABLE 33 (CONTINUED)

RUNOFF OF LITTLE RIVER AT CRANNELL

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F50100
LOCATION LAT 41-00-40N, LONG 124-04-50W
NE1/4 SEC. 8, T7N, R1E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 44 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
1911	600	1500	3200	22400	16200	9700	12200	9600	1900	900	500	300	790
1912	200	900	2000	24000	17300	8900	8300	15900	2700	1200	600	1300	833
1913	400	16800	21900	24300	8000	6200	11400	5300	1400	1100	500	300	976
1914	100	2600	22700	58800	17100	6400	10400	7300	1500	600	500	300	1283
1915	600	11000	25800	25000	26100	13500	12600	6300	2100	900	500	400	1248
1916	500	10300	24100	23300	24500	12600	11700	5900	2000	800	500	300	1165
1917	200	1700	11100	10400	26500	10000	16400	6700	2200	900	500	200	868
1918	200	1300	7700	4400	19800	15000	10500	2800	900	400	300	200	635
1919	200	2100	4700	25100	32000	17700	9000	4100	1000	500	300	100	968
1920	300	500	11200	1900	900	9400	21000	4300	1200	900	300	200	521
1921	500	32000	37900	20000	15500	7000	3400	2700	900	300	200	100	1205
1922	200	1600	12100	5300	25200	12300	13000	7500	2100	600	400	200	805
1923	400	2400	23800	16300	7300	2300	12000	2700	1100	600	300	200	694
1924	900	1100	6100	8400	21100	2200	2100	1100	300	200	200	100	438
1925	2200	14000	18100	7400	40300	5000	16300	7700	2300	700	400	300	1147
1926	400	2000	8300	8400	41400	4800	6100	2800	600	300	200	100	754
1927	400	22800	20500	17000	36600	8700	10000	3100	1100	500	200	100	1210
1928	200	11400	9500	15500	12600	17800	16900	4000	1100	600	200	100	899
1929	200	5200	13900	7200	12800	4400	7400	4200	2200	800	400	100	588
1930	100	100	27500	17000	14400	8900	4900	3300	1000	500	300	200	782
1931	300	1800	2100	23800	6900	12900	3700	1500	1000	500	200	100	548
1932	700	5000	29900	16900	7400	5200	5700	6100	1400	600	300	100	793
1933	100	600	7100	13500	11100	21500	8000	11300	4000	1400	600	300	795
1934	300	800	21500	16100	9500	7800	4800	3200	1000	600	400	100	661
1935	400	15300	10200	23000	7300	11300	20300	4800	1100	500	300	100	946
1936	300	600	5700	47000	28500	6000	7000	2500	2400	900	400	100	1014
1937	100	200	700	2200	24700	18500	20700	6600	3200	1200	500	200	788
1938	300	29300	31900	11100	32900	23800	8700	5000	1600	600	300	100	1456
1939	700	3600	22100	9200	13800	11600	3000	2600	1000	500	300	100	685
1940	100	200	13200	28600	40200	18300	10200	3000	1000	500	300	200	1158
1941	300	1800	34800	31300	19400	11700	14800	6100	2200	1000	600	300	1243
1942	200	1600	44000	19400	26900	2800	8600	7800	3600	1200	600	200	1169
1943	200	8600	25600	34500	10200	7200	6900	3700	2300	800	500	200	1007
1944	1300	2500	3200	12900	13300	13300	6500	5500	2600	1300	700	200	633
1945	200	15000	21100	7600	23000	9900	6500	4900	1900	800	400	200	915
1946	500	17700	53700	14200	6500	5000	3400	1700	600	400	200	100	1040
1947	200	9000	10200	2100	14300	17700	8600	2000	2100	800	600	200	678
1948	3900	3800	2700	22200	6400	9400	24300	11200	4600	1600	800	500	914
1949	700	3400	17200	6800	17400	26200	7300	3700	1100	700	400	100	850
1950	200	1200	2000	27300	19100	15800	10600	5400	1600	800	400	300	847
1951	11800	11300	31300	34200	18400	7200	2200	4600	900	500	300	200	1229
1952	800	8500	36200	21500	28600	9600	8200	5100	1400	1000	400	200	1215
1953	100	300	20100	49400	11200	10200	10000	15600	7300	1800	700	400	1271
1954	600	18200	18000	32100	16000	8000	9200	1700	2000	800	500	400	1075
1955	300	3200	23300	15500	6300	4300	9300	7000	1200	800	500	300	720
1956	600	7000	45400	48700	23400	11800	3600	3000	1400	700	400	300	1463
1957	3200	2300	16400	11300	12900	37100	7100	7400	2000	900	500	400	1015
1958	1900	12200	26400	27900	39500	10400	12100	2400	1500	800	500	400	1360
1959	400	2900	4200	20200	23700	9600	4300	1500	700	400	200	300	684
1960	400	300	1300	5100	24400	19500	8900	17200	3300	1000	500	300	822
TOTAL	39900	329500	893600	977700	958800	566400	480100	271400	91600	38700	20600	12000	4680
MEAN	800	6600	17900	19600	19200	11300	9600	5400	1800	800	400	200	93
PERCENT	0.9	7.1	19.1	20.8	20.5	12.1	10.3	5.8	1.9	0.9	0.4	0.2	10

TABLE 34

RUNOFF OF REDWOOD CREEK NEAR BLUE LAKE

Location: Lat. 40° 54' 20", Long. 123° 48' 55", in NE 1/4 Sec. 15, T6N, R3E, HB&M, on right bank 400 feet upstream from Lupton Creek and 9.1 miles east of town of Blue Lake.
Drainage area: 67.5 square miles.
Records available: June 1953 to September 1958 (Discontinued).
Recorded extremes: Maximum discharge, 12,100 cfs (December 21, 1955); Minimum discharge 5.2 cfs (September 30, 1958).
Remarks: No storage or diversion above station.

Streamflow at this station is unregulated, so the recorded flows were taken as full natural flows.

Estimates of monthly and seasonal natural flow for 1911-12, 1912-13, 1958-59, and 1959-60 were obtained by multiplying the recorded flows at the gaging station at Orick by a factor of 0.2497, the drainage area-mean precipitation ratio of the two gaging stations.

Estimates of seasonal natural flows for 1910-11 and 1913-14 through 1952-53 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$Y = -46,700 + 0.0827\ X$$

Y = seasonal natural flow, Redwood Creek near Blue Lake

X = seasonal natural flow, Smith River near Crescent City

$\bar{r}$ = correlation coefficient = 0.9477

$\bar{S}y$ = standard error of estimate = 29,100 acre-feet

TABLE 34 (Continued)

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3012.15.2. The gage on the Smith River near Crescent City was used as the base station.

Monthly and seasonal full natural flows at this station for the 50-year period from 1910-11 through 1959-60 are tabulated on the following page.

TABLE 34 (CONTINUED)

RUNOFF OF REDWOOD CREEK NEAR BLUE LAKE

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F55400
LOCATION LAT 40-54-20N, LONG 123-48-55W
NE1/4 SEC. 15, T6N, R3E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 68 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	1500	17700	28000	32200	20000	16500	11700	14000	4200	1600	700	700	148800
1912	400	1700	2800	46900	50700	21800	12700	26500	4700	1900	2200	1700	174000
1913	2800	50900	55900	56700	10700	11000	25700	8800	2500	1500	300	200	227000
1914	2700	10000	13200	57300	18500	22200	13500	9900	5100	1700	700	700	155500
1915	5300	5100	11300	24100	19100	14900	8900	14500	5400	1600	800	500	111500
1916	1200	16100	34000	30800	50000	41300	17800	17700	5300	5300	1100	600	221200
1917	1400	6800	21700	24300	22300	36100	34500	30900	14200	4200	900	600	197900
1918	1300	3100	26000	41200	33500	27800	14900	10700	2800	1300	700	500	163800
1919	1400	6500	12300	44000	41000	47100	26500	19100	4700	1500	800	700	205600
1920	1900	17200	40000	19700	8800	17100	28700	15500	4100	1700	900	1800	157400
1921	7200	30200	55300	45600	40400	32600	22200	34400	9300	1800	800	700	280500
1922	2400	21300	33700	28300	26900	31700	24900	25300	9200	1800	800	500	206800
1923	1600	3400	19400	54300	17100	20000	12300	11400	6500	1900	800	500	149200
1924	2200	3800	21200	16900	20100	10000	9500	5000	1800	1000	500	400	92400
1925	3500	5000	35500	59400	56500	14700	22800	14700	7100	2000	900	700	222800
1926	1400	3100	11300	13300	41800	11000	4200	4400	1600	800	500	500	93900
1927	1700	15900	32900	38500	53700	23400	12100	14000	6200	1900	800	600	201700
1928	2400	17500	18500	29200	11400	32600	28200	11000	3000	1400	700	500	156400
1929	1300	2800	7100	15000	13300	17600	23000	11400	5700	1500	600	400	99700
1930	1000	1500	23500	16200	30800	10800	5200	8300	3300	1100	500	400	102600
1931	1200	4300	5800	11600	6200	19200	16400	4700	2200	1100	500	400	73600
1932	1700	11400	26400	28500	14900	35400	17200	13800	4300	1500	600	400	156100
1933	700	9000	20400	26700	22700	36600	13500	36000	15400	3100	1000	800	185900
1934	1000	1300	20000	26300	7700	9800	6000	5700	2000	900	400	300	81400
1935	4700	22400	25500	31300	21600	28200	23200	17800	3800	1500	700	500	181200
1936	900	2900	15200	61500	20400	12300	8500	11900	6600	2000	700	500	143400
1937	400	500	3300	5400	21000	26400	39700	17800	15100	3300	1000	600	134500
1938	1600	21600	27800	27000	53000	72000	22300	16100	5400	1600	700	500	249600
1939	600	6100	16100	12800	20400	23100	5400	3800	2200	1000	400	300	92200
1940	500	600	18100	27900	44600	31100	11600	9500	2700	1200	500	600	148900
1941	1500	6700	31700	42800	19400	13500	15700	14000	4600	1900	800	700	153300
1942	600	5900	48500	28600	30800	10000	8300	23600	8200	2200	800	500	168000
1943	600	28100	71900	57400	25800	17300	21100	10400	12000	2300	1100	600	248600
1944	2700	9500	8200	17600	13200	13200	12000	10100	7500	1800	700	500	97000
1945	700	12900	14900	23000	46600	28500	17200	18700	4800	1800	800	500	170400
1946	800	25400	61500	40000	26200	29700	11500	7900	3700	1600	700	500	209500
1947	1000	15700	14200	11500	17500	24900	12700	3800	7200	3800	1600	700	114600
1948	8900	7000	10800	49200	26800	21200	34200	24300	7600	2400	900	700	194000
1949	1100	7400	34000	10000	27400	26000	8900	17200	3600	1300	600	400	137900
1950	900	9100	10400	53800	32100	45400	15500	13000	4400	1500	600	500	187200
1951	30000	27900	59400	64400	42400	24500	9100	13900	3700	1600	800	600	278300
1952	5400	21300	55700	39900	49600	23100	17000	13900	5200	2000	800	600	234500
1953	500	1000	24500	93900	27100	21900	17200	30000	13300	3000	1200	700	234300
1954	1400	32200	33600	50600	29400	20900	17800	4400	5100	1800	800	700	198700
1955	800	5400	23800	22700	11900	12200	16900	14400	3400	1500	600	500	114100
1956	700	10200	96100	100100	42000	26000	14900	10800	3700	1400	700	500	307100
1957	6600	4400	14400	19000	28300	64700	19400	17400	5100	1900	900	800	182900
1958	5800	31500	48000	54600	82100	24500	26200	7100	3500	1300	600	400	285600
1959	500	4800	6700	40000	42800	19300	11900	3600	1700	900	400	600	133200
1960	700	500	2300	9100	48800	33800	19300	25900	7700	1900	800	400	151200
TOTAL	129100	586600	1352800	1781100	1489300	1254900	849900	729000	282400	92600	38700	29500	8615900
MEAN	2600	11700	27100	35500	29800	25100	17000	14600	5600	1900	800	600	172300
PERCENT	1.5	6.8	15.7	20.5	17.3	14.6	9.9	8.5	3.3	1.1	0.5	0.3	100.0

TABLE 35

RUNOFF OF REDWOOD CREEK AT ORICK

Location: Lat. 41° 17' 20", Long. 124° 03' 30", in NE 1/4 Sec. 4, T10N, R1E, HB&M, on downstream side of left pier of bridge on U. S. Highway 101 at Orick, 0.9 mile downstream from Prairie Creek.
Drainage area: 278 square miles.
Records available: September 1911 to September 1913, October 1953 to date.
Recorded extremes: Maximum discharge, 50,000 cfs (December 22, 1955); Minimum discharge, 10 cfs (September 22-24, 1911). From high water marks, flood of January 18, 1953, equalled gage height of December 22, 1955, (discharge, 50,000 cfs).
Remarks: No storage or diversion above station.

Streamflow at this station was unregulated during the 50-year study period, so the recorded flows were taken as full natural flows.

Estimates of seasonal natural flows for 1910-11 and 1913-14 through 1952-53 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$Y = -35{,}800 + 0.2786\ X$$

Y = seasonal natural flow, Redwood Creek at Orick

X = seasonal natural flow, Smith River near Crescent City

$\bar{r}$ = correlation coefficient = 0.9754

$\bar{S}y$ = standard error of estimate = 53,500 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Smith River near Crescent City was used as the base station.

TABLE 35 (Continued)

Monthly and seasonal full natural flows at this station for the 50-year period from 1910-11 through 1960-61 are tabulated on the following page.

TABLE 35 (CONTINUED)

RUNOFF OF REDWOOD CREEK AT ORICK

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F55100
LOCATION LAT 41-17-20N, LONG 124-03-30W
NE1/4 SEC. 4, T10N, R1E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 278 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	6100	82200	126200	131100	91000	64700	49200	48700	12400	4800	3100	2900	622400
1912	1800	7000	11300	188000	203000	87300	50800	106000	18900	7600	8700	6800	697200
1913	11100	204000	224000	227000	42900	44000	103000	35300	9900	6200	1100	1000	909500
1914	10700	46900	59900	235900	85100	87900	57400	34700	15100	5000	3300	3100	645000
1915	22900	25700	55700	108200	95100	63800	41100	55500	17300	5200	3700	2500	496700
1916	4500	70100	143700	118100	213400	152000	70300	57900	14500	14600	4400	2500	866000
1917	5600	31500	97400	98900	101200	140700	144400	107100	41500	12500	4100	2800	787700
1918	5300	14400	115400	165600	149900	107300	61700	36600	8100	3700	2900	2000	672900
1919	5500	28900	53300	173000	179700	178200	107200	64000	13200	4200	3500	2900	813600
1920	7500	78900	178600	79600	39500	66100	119500	53200	11900	5000	3800	7800	651400
1921	25900	128000	227700	169800	167900	116500	85200	109300	25000	4800	3100	2700	1065900
1922	9100	94900	145100	110700	117200	119100	100600	84400	25900	5100	3400	2300	817800
1923	6500	16200	89400	226500	79800	80300	53200	40500	19600	5900	3400	2300	623600
1924	9600	19400	105400	76100	101300	43400	44400	19400	5700	3200	2600	1900	432400
1925	13000	21700	149100	225600	239600	53700	89400	47700	19500	5400	3900	3000	871600
1926	6000	15800	55300	59100	206900	46800	19000	16500	5100	2600	2400	2200	437700
1927	6400	69300	139300	147600	229900	86200	47900	45700	17200	5300	3100	2600	800500
1928	9700	81100	83400	119300	51700	127700	118700	38400	8800	4300	2900	2100	648100
1929	6000	14800	36000	69400	68500	78500	109600	45100	19000	5100	3100	2100	457200
1930	4400	7600	113900	71100	150600	45700	23600	31100	10600	3600	2500	1900	466600
1931	5700	24400	32200	57900	34900	92400	84700	20200	8000	4000	2600	2100	369100
1932	6600	53100	119400	117100	68100	140000	72900	48200	12500	4500	2800	1800	647000
1933	2700	42500	93400	110500	104800	145300	57800	127300	45800	9300	4500	3400	747300
1934	4700	7100	105800	124900	41300	45000	29700	23400	6900	3200	2300	1800	396100
1935	18000	100700	111300	123900	95300	107200	94700	60000	10900	4400	2900	2100	731400
1936	3900	13900	70900	258600	95700	49900	37000	42700	20100	6100	3400	2100	604300
1937	1800	2700	15900	23700	103600	112400	181000	67300	48000	10500	4600	2700	574200
1938	5700	92600	115700	101800	222700	260900	86900	51700	14700	4300	2800	2100	961900
1939	2600	31700	80700	58300	103100	100300	25600	14800	7300	3300	2200	1600	431500
1940	1800	2600	81300	113600	203600	121600	48900	33000	7800	3400	2400	2400	622400
1941	6000	31300	143000	175100	88300	53100	66100	48800	13600	5700	3500	3000	63750
1942	2500	27000	215100	114900	138100	38600	34300	80900	23600	6200	3500	2100	68680
1943	2300	118900	295200	213500	107200	61700	81100	33100	32100	6300	4300	2600	95830
1944	12000	50200	42200	82100	68200	58800	57400	40000	25100	5900	3700	2400	44800
1945	2600	58700	65700	91700	208100	109300	71000	63800	13700	5000	3300	2300	69520
1946	3000	109000	256100	151000	110300	107900	44900	25600	10000	4300	2700	1900	82670
1947	4400	77800	68500	50200	85200	104700	57000	14200	22600	12100	7300	3300	50730
1948	34700	31900	47900	197700	120100	81600	141500	83400	22000	6900	4000	2900	77460
1949	4300	35200	155500	41500	127000	103600	38200	61000	10700	3900	2800	2000	58570
1950	3400	41200	45900	214200	142900	174000	63800	44400	12700	4200	2800	2000	75150
1951	107100	116600	240500	236500	173600	86400	34400	43600	9800	4300	3200	2300	105830
1952	19600	90200	229200	148700	206200	82800	65300	44200	13800	5300	3300	2300	91090
1953	1900	4600	106600	369800	119200	82800	69900	100700	37800	8500	5200	3100	91010
1954	8500	170800	149300	245200	126500	81600	73300	16700	16000	6800	3800	3700	90220
1955	4200	29600	126000	144400	49100	51200	84200	44000	10600	4800	2100	2100	55230
1956	3400	52400	366000	371400	180000	112900	40000	26200	11600	5700	3000	1700	117430
1957	28800	27200	88300	86800	102000	261600	71000	65700	21300	8300	3500	2700	76720
1958	20300	89600	159600	184200	302200	87700	97300	20300	11400	5100	2400	2100	98220
1959	1900	19400	27000	160200	171400	77300	47600	14300	6700	3500	1500	2400	53320
1960	2900	2100	9200	36400	195600	135200	77200	103800	31000	7500	3400	1700	60600
TOTAL	504900	2613400	5873500	7206400	6508500	4917700	3530900	2540400	857300	287400	168800	128100	3513730
MEAN	10100	52300	117500	144000	130200	98400	70600	50800	17100	5700	3400	2600	70270
PERCENT	1.4	7.4	16.7	20.7	18.5	14.0	10.0	7.2	2.4	0.8	0.5	0.4	100.

TABLE 36

FROM MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

50-YEAR MEAN PERIOD, 1910-60

Subunit and related gaging stations		October		November		December		January		February		March		April		May		June		July		August		September		Total
Ref. No.	Name	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Acre-feet
F-5 A	Ruth	0.6	1,100	4.5	9,800	14.6	31,500	21.6	46,400	23.0	49,800	18.2	39,200	10.7	23,100	4.9	10,600	1.4	3,200	0.3	600	0.1	200	0.1	200	215,700
F-5 1200	Mad River near Forest Glen (gage)		1,100		9,800		31,500		46,400		49,800		39,200		23,100		10,600		3,200		600		200		200	215,700
F-5B	Butler Valley	1.0	6,000	6.4	38,300	16.1	96,000	20.4	121,500	21.9	130,500	15.5	92,200	10.7	64,200	5.0	29,700	1.8	10,600	0.7	4,200	0.3	1,800	0.2	1,200	596,200
F-5C	North Fork	0.8	900	6.2	6,900	16.1	17,900	20.4	22,600	22.0	24,400	15.9	17,600	10.9	12,100	5.1	5,700	1.8	2,000	0.5	500	0.2	200	0.1	100	110,900
F-5D	Blue Lake	0.8	1,000	6.2	6,600	16.1	17,300	20.4	21,800	21.9	23,600	15.9	17,000	10.9	11,800	5.1	5,500	1.8	1,900	0.5	600	0.2	200	0.2	200	107,500
F-5 1100	Mad River near Arcata (gage)		8,800		61,600		161,000		203,500		219,200		158,700		109,300		50,400		17,300		5,000		2,300		1,500	998,600
	Subtotal: (Mad River Basin)		9,000		61,600		162,700		212,300		228,300		166,000		111,200		51,500		17,700		5,900		2,400		1,700	1,030,300
F-5 8	Snow Camp	1.5	2,600	6.8	11,700	15.7	27,100	20.5	35,600	17.3	29,800	14.6	25,100	9.9	17,000	8.5	14,600	3.2	5,600	1.1	1,800	0.5	800	0.4	600	172,300
F-5 5400	Redwood Creek near Blue Lake (gage)		2,600		11,700		27,100		35,600		29,800		25,100		17,000		14,600		5,600		1,800		800		600	172,300
F-5F	Beaver	1.4	4,000	7.5	21,100	16.8	48,100	20.3	57,200	18.6	53,400	14.0	40,200	10.1	28,500	7.2	20,300	2.4	6,800	0.8	2,400	0.5	1,400	0.4	1,100	284,500
F-5G	Orick	1.4	4,000	7.4	20,800	16.8	47,000	20.5	57,600	18.6	52,100	14.0	39,300	10.0	28,100	7.2	20,300	2.4	6,800	0.8	2,300	0.5	1,200	0.4	1,000	280,500
F-5 5100	Redwood Creek at Orick (gage)		10,100		52,300		117,400		144,000		130,100		98,300		70,600		50,800		17,100		5,800		3,400		2,600	702,500
	Subtotal: (Redwood Creek Basin)		10,600		53,600		122,200		150,400		135,300		104,600		73,600		55,200		19,200		6,500		3,400		2,700	737,300
F-5H	Big Lagoon	0.9	1,800	7.1	14,000	19.1	37,700	21.0	41,400	20.5	40,500	12.1	23,800	10.2	20,200	5.8	11,500	1.9	3,700	0.8	1,600	0.4	900	0.2	400	197,500
F-5J	Little River	0.9	900	7.1	7,300	19.1	19,800	21.0	21,800	20.5	21,300	12.1	12,500	10.2	10,600	5.8	6,000	1.9	2,000	0.8	800	0.4	500	0.2	200	103,700
F-5 0100	Little River at Crannell (gage)		800		6,600		17,900		19,600		19,200		11,300		9,600		5,400		1,800		800		400		200	93,600
	Total: Mad River - Redwood Creek Hydrographic Unit	1.1	22,300	6.6	136,500	16.6	342,400	20.6	425,900	20.6	425,400	14.8	306,900	10.4	215,600	6.0	124,200	2.1	42,600	0.7	14,800	0.3	7,200	0.2	5,000	2,068,800

Ground Water Hydrology

The most significant ground water basin in the Mad River-Redwood Creek Hydrographic Unit extends southward into the Eel River Hydrographic Unit and is discussed with the ground water hydrology of that unit. See pages 196 and 219. The only other ground water basin in the unit is the Prairie Creek area which is discussed below.

Prairie Creek Area

The Prairie Creek area is a densely timbered and hilly region located along the coast north of Orick. The area is underlain by poorly permeable sediments which may be correlative with the Hookton Formation farther to the south near the Mad River. The sediments are composed of poorly sorted and partially consolidated fine sand and gravel which may yield sufficient water to wells for domestic or stock usage. No wells are known to have been drilled in the area where these sediments are found and consequently their true water-bearing characteristics are unknown.

Water Quality

Ground and surface waters of the Mad River-Redwood Creek Hydrographic Unit have been characterized in those subunits from which data are available. These characteristics are presented in Table 37. In general, surface waters of the entire hydrographic unit are a soft, calcium bicarbonate type, containing low concentrations of total dissolved minerals and boron. Ground waters exhibit about a fourfold increase in mineralization over associated surface waters, and are generally a moderately hard calcium-magnesium bicarbonate type, containing somewhat lower than moderate concentrations of total dissolved minerals and boron.

The mineral character of surface waters throughout the hydrographic unit indicates an excellent quality, well suited for all anticipated uses. No potential surface water quality problems are apparent.

Ground waters, where utilized, are suitable for all intended uses. However, the utility of some of the coastal aquifers, particularly in the Blue Lake and Orick Subunits, is being restricted due to sea-water intrusion. This sea-water intrusion poses an existing as well as a potential ground water quality problem. Some wells near the coastline have already been forced out of use while others are being degraded to the point of becoming water quality problems.

TABLE 37

WATER QUALITY CHARACTERISTICS

MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

Hydrographic subunits	Mineral classification	Range of dissolved mineral concentrations: Electrical conductivity (micromhos)	Hardness (ppm)	Boron (ppm)
SURFACE WATERS				
Snow Camp and Beaver	Calcium bicarbonate	90-182	35-77	0.0-0.21
Orick	Calcium bicarbonate	64-158	26-68	0.0-0.2
Big Lagoon	Sodium-calcium bicarbonate chloride	77	19	0.08
Little River	Calcium bicarbonate	59-98	16-30	0.02-0.04
Ruth	Calcium bicarbonate	65-128	28-55	0.00-0.20
Butler Valley	Calcium bicarbonate	118-280	49-134	0.03-0.16
North Fork	Calcium bicarbonate	146	62	0.02
Blue Lake	Calcium bicarbonate	78-287	19-136	0.00-0.26
GROUND WATERS				
Orick	Calcium-sodium bicarbonate-chloride	157-582	65-129	0.05-0.12
Big Lagoon	Sodium-calcium chloride-bicarbonate	93-100	21-28	0.03-0.15
Blue Lake	Calcium-magnesium bicarbonate	85-517	24-252	0.0-1.1

EEL RIVER HYDROGRAPHIC UNIT

Surface Water Hydrology

General Description

The Eel River Hydrographic Unit includes the area drained by the Eel River and its many tributaries, the Eureka Plain Subunit to the north, and the Cape Mendocino Subunit to the south. The Eureka Plain Subunit encompasses the watersheds of Elk River, Freshwater Creek, Jacoby Creek, and other streams flowing into Humboldt Bay. The Cape Mendocino Subunit includes the watersheds of Bear River, Mattole River, and coastal streams on the west slope of the King Mountain Range.

The unit was recognized by early settlers as an area with abundant water. The following quotation, almost poetic, eulogized this abundance 83 years ago:

> "One of the features of Humboldt County is its wealth in pure water. One finds it everywhere -- pure and cold as the fountains of the upper Sierra. An old resident says there is not, he thinks, 160 acres in the county without a permanent spring of fine water. The springs of pure, cold water about this county are a marvel, and it is impossible to fully describe their beauty and usefulness. There are thousands and thousands. Every hill and mountain side teems with them and the weary traveller and his thirsty beast find streams of pure water, cool and fresh, gushing from the wayside banks, and gathered into troughs for his convenience. The flow of these springs varies from a few gallons a day to barrels per minute." (Anonymous, 1881.)

The streams of the Eel River Hydrographic Unit have an infamous reputation for flooding. Pioneers in the winter of 1849-50 were greatly inconvenienced by high waters, and 31 years later, in the first written history of Humboldt County, the following statement was made:

> "The current during the season of floods is terrific. The canyons are then but conduits for the seething flood, bearing on along the banks and swept along by the flood; old logs dislodged from the drifts, where they had lain for years, are carried out into the ocean. These rivers rise very suddenly with heavy rain in the winter." (Anonymous, 1881.)

This periodic occurrence of damaging floods constitutes the most serious water problem of the unit. Major floods occurred in 1907, 1938, 1950, and 1955, the latter causing damages within the Eel River Basin estimated at over $22,000,000. This flood was the greatest on record, and caused widespread destruction to urban areas, farmlands, lumber mills, and transportation facilities.

A need also exists for increasing the meager streamflow during the summer months for the enhancement of fish habitat and improvement of recreation facilities.

Precipitation

Precipitation in the Eel River Hydrographic Unit averages about 62 inches annually, most of which is in the form of low intensity winter and spring rains. Although there is generally snow along the eastern divide, snowmelt runoff is considered significant only within the watershed of the Middle Fork Eel River. Precipitation within the unit is subject to considerable variation, both annually and geographically. For example, historical annual precipitation at Willits has ranged from 18.55 to 97.16 inches; at Branscomb from 46.12 to 132.62 inches; and at Laytonville from 38.67 to 135.02 inches. Typically, the first seasonal precipitation occurs in late September or October, a maximum occurs from

December to February, and the last generally occurs in late May or early June. Precipitation in late June, July, August, or early September is generally infrequent and insignificant.

Runoff

Mean annual runoff from the Eel River Hydrographic Unit is about 8,080,000 acre-feet which is equivalent to a depth of about 34 inches over the entire unit. Because of the relative lack of snow and natural storage, streamflow is highly responsive to rainfall. The runoff pattern, therefore, corresponds to the rainfall pattern, and there are two distinct hydrologic seasons -- a wet season and a dry season. The wet, or flood season, begins with the first major fall rains and continues through late May or early June. The dry season extends through the interim. Many streams which flow continuously through the winter dry up almost completely during the summer months, and the area is, in effect, waterless. Certain tributary streams rage in flood during the winter, and dry out to a series of pools during the late summer. Thus, there is a period of from three to five months annually in which all streamflow must be supplied from ground water, channel storage, snowmelt, or reservoir storage.

The variation of surface runoff is well illustrated by streamflow records of the gaging station on the Eel River at Scotia. Mean monthly flows at this station are generally 10,000 - 25,000 second-feet during the months of January and February, and

Recreation on Eel River during period of low flow

Eel River at Weott during the flood of December 1955
(Photograph by Eureka Newspapers, Inc.)

about 100-200 second-feet during August and September. Extremes in flow have varied from 10 second-feet to 541,000 second-feet, and seasonal natural yields have ranged from 868,000 acre-feet to 11,665,000 acre-feet.

Water Development

Surface water development within the unit controls only a minor portion of the unit's streamflow. The total storage capacity of reservoirs within the unit, as listed in Department of Water Resources Bulletin No. 17, "Dams Within Jurisdiction of the State of California," January 1962, and the files of the State Water Rights Board, is 97,613 acre-feet, or about 1.2 percent of the mean seasonal natural runoff. In addition, the diversion data collected in 1958-59 for Bulletin 94-8, "Land and Water Use in the Eel River Hydrographic Unit," listed 18 small ponds and reservoirs having an estimated combined capacity of about 300 acre-feet. Dams within the unit that are under the jurisdiction of the State, as listed in Bulletin No. 17, are as follows:

Name of dam	Stream	Location	Year completed	Storage capacity in acre-feet
Arcata	Jolly Giant Creek	Sec. 27, T6N, R1E, HB&M	1937	46
Benbow	S.F. Eel River	Sec. 36, T4S, R3E, HB&M	1932	1,060
Morris	James Creek	Sec. 33, T18N, R13W, MDB&M	1927	835
Scott (Lake Pillsbury)	Eel River	Sec. 14, T18N, R10W, MDB&M	1921	93,724
Van Arsdale	Eel River	Sec. 30, T18N, R11W, MDB&M	1907	700

There are numerous small lakes and ponds, both natural and man-made, that are not included in the total estimated storage above. The man-made ponds are primarily small stockwatering reservoirs, log ponds, etc., that were considered to be too small to be included in Bulletin 94-8. The natural lakes and ponds, generally quite small in size, are usually formed in landslide pockets. Their occurrence appears to be limited almost entirely to the eastern and central belts of the mountainous region. No attempt was made to estimate the storage of these ponds or to evaluate their effect on the hydrology of the unit.

Two other water developments are significant in considering the surface water hydrology of the unit. First, the City of Eureka has, since 1933, imported its water supply from the Mad River. This water supply was developed by the construction of Sweasey Dam in 1938 and Ruth Dam in 1961. The amount of water imported averaged about 3,300 acre-feet per year for the eight-year period from 1953 through 1960. The second development, a power project on the main stem of the Eel River near Potter Valley, has exported a significant amount of water from the unit for many years. This export began in 1910, after the completion of Van Arsdale Dam, and was augmented by the construction of Scott Dam in 1921. Eel River flows, supplemented by controlled releases from Lake Pillsbury during the summer months, are diverted from the reservoir impounded by Van Arsdale Dam through a tunnel to a powerhouse in Potter Valley. After passing through the powerhouse, a portion of the water is diverted for irrigation use in Potter Valley and the remainder flows into the East Fork

Russian River. Records of the amounts of water exported from the Eel River Hydrographic Unit by this development are presented in Table 43 of this report.

<u>Stream Gaging Stations and Records</u>

Streamflow records have been collected in the Eel River Hydrographic Unit since 1909, primarily by the U. S. Geological Survey. These records are considered adequate to estimate the natural flow of the major streams within the unit. Table 38 lists all gaging stations within the unit, as shown in the department's "Index of Gaging Stations in and Adjacent to California." The locations of stations utilized in preparing this report are shown on Plate 1.

TABLE 38

STREAM GAGING STATIONS IN THE
EEL RIVER HYDROGRAPHIC UNIT

USGS station No.	DWR ref. No.	Station	Drainage area in sq. miles	Period of record
*11-4690.00	F71100	Mattole River near Petrolia	242	1911-13, 1950-date
*11-4695.00	F72100	N.F. Mattole River near Petrolia	38	1951-57
11-4700.00	F61551	Lake Pillsbury near Potter Valley	289	1922-date
*11-4705.00	F61550	Eel River below Scott Dam, near Potter Valley	290	1922-date
*11-4710.00	F61970	Potter Valley Powerhouse Tailrace near Potter Valley	--	1909-date
*11-4715.00	F61450	Eel River at Van Arsdale Dam, near Potter Valley	349	1909-date
11-4720.00	F61400	Eel River at Hearst	465	1910-13
11-4722.00	F61350	Outlet Creek near Longvale	161	1956-date
*11-4725.00	F61330	Eel River above Dos Rios	705	1950-date
11-4729.00	F63200	Black Butte River near Covelo	162	1958-date
*11-4730.00	F63100	M.F. Eel River below Black Butte River, near Covelo	367	1951-date
11-4731.00	F63105	Williams Creek near Covelo	31	1961-date
11-4735.00	F63120	M.F. Eel River near Covelo	405	1911-23
11-4736.00	F63075	Short Creek near Covelo	15	1958-date
11-4736.50	F63085	Mill Creek below Alder Creek, near Covelo	17	1958-date
11-4737.00	F63050	Mill Creek near Covelo	97	1956-date

TABLE 38 (Continued)

USGS station No.	DWR ref. No.	Station	Drainage area in sq. miles	Period of record
*11-4740.00	F61300	Eel River below Dos Rios	1,484	1911-13, 1951-date
11-4744.00	F62200	Hulls Creek near Covelo	23	1961-date
*11-4745.00	F62100	N.F. Eel River near Mina	250	1953-date
*11-4750.00	F61200	Eel River at Alderpoint	2,079	1955-date
*11-4755.00	F64300	S.F. Eel River near Branscomb	44	1946-date
11-4757.00	F64400	Tenmile Creek near Laytonville	50	1957-date
11-4760.00	F64150	S.F. Eel River at Garberville	468	1911-13, 1939-40
*11-4765.00	F64100	S.F. Eel River near Miranda	537	1940-date
11-4766.00	F61150	Bull Creek near Weott	28	1960-date
11-4767.00	F61140	Larabee Creek near Holmes	84	1959-date
*11-4770.00	F61100	Eel River at Scotia	3,113	1910-14, 1917-date
*11-4775.00	F65400	Van Duzen River near Dinsmores	80	1953-58
11-4777.00	F68050	S.F. Van Duzen River near Bridgeville	36	1958-date
*11-4780.00	F65320	Van Duzen River at Bridgeville	200	1911-13, 1939-51
*11-4785.00	F65300	Van Duzen River near Bridgeville	216	1950-date
*11-4790.00	F65120	Yager Creek near Carlotta	127	1953-60

TABLE 38 (Continued)

USGS station No.	DWR ref. No.	Station	Drainage area in sq. miles	Period of record
11-4795.00	F65100	Yager Creek at Carlotta	134	1911-13
11-4797.00	F60620	Elk River near Falk	44	1957-date
11-4800.00	F60820	Jacoby Creek near Freshwater	6	1954-date

*Stations for which unimpaired flows are tabulated in this report.

Streamflow Estimates

Estimates of monthly and annual natural flows for the 50-year period 1910-11 through 1959-60 were compiled for all gaging stations within the Eel River Hydrographic Unit, except one, for which five or more years of record were available. The majority of these estimates were obtained by revising the Division of Resources Planning office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. This report presented annual natural flows for the 50-year period 1907-08 through 1956-57 and monthly natural flows for the period 1920-21 through 1946-47 for all gaging stations within the Eel River watershed above Scotia. This report was extended to include monthly and annual natural flows for the new 50-year base period (1911-60), using the original methods and procedures wherever possible. A brief summary of these methods and procedures pertinent to the individual gaging stations is included with the tabulations of streamflow, Tables 40 through 55. Detailed data on correlations used, other calculations attempted, adjustment factors, etc., are available in the files of the North Coastal Area Investigation.

Flow estimates were prepared for five additional stations on the Van Duzen River, Yager Creek, and Mattole River, which were not included in the November 1959 report. Flow estimates were not prepared for the gaging station "Jacoby Creek near Freshwater," which has six years of record, but measures the flow from a drainage area of only six square miles.

Mean seasonal natural flows for the 50-year period from 1910-11 through 1959-60 for the gaging stations, intermediate areas between gages, and ungaged areas within the Eel River Hydrographic Unit are summarized in Table 39.

Estimated mean monthly distribution of natural runoff from the Eel River Hydrographic Unit by subunits is presented in Table 56.

TABLE 39

SUMMARY OF MEAN SEASONAL FULL NATURAL FLOWS
IN THE EEL RIVER HYDROGRAPHIC UNIT FOR
THE 50-YEAR PERIOD FROM 1910-11 THROUGH 1959-60

Gaging Station or Intermediate Area	Mean full natural flow (in acre-feet)	
Eel River at Scott Dam	377,100	
Scott Dam to Van Arsdale Dam	70,700	
Eel River at Van Arsdale Dam	447,800	
Van Arsdale Dam to above Dos Rios	548,800	
Eel River above Dos Rios	996,600	
M. F. Eel River below Black Butte River	630,200	
Black Butte and above Dos Rios to below Dos Rios	419,500	
Eel River below Dos Rios	2,046,300	
N. F. Eel River near Mina	373,900	
Below Dos Rios and Mina to Alderpoint	416,900	
Eel River at Alderpoint	2,837,100	
S. F. Eel River near Branscomb	111,600	
Branscomb to Miranda	1,063,100	
S. F. Eel River near Miranda	1,174,700	
Alderpoint and Miranda to Scotia	1,157,000	
Eel River at Scotia	5,168,800	
Van Duzen River near Dinsmores	218,500	
Dinsmores to Bridgeville	327,500	
Van Duzen River near Bridgeville	546,000	
Yager Creek near Carlotta	263,600	
Ungaged area in Eel River Basin below Carlotta, Bridgeville, and Scotia	320,000	
Subtotal, Eel River Basin		6,298,400
Mattole River near Petrolia	840,500	

TABLE 39 (Contd.)

Gaging Station or Intermediate Area	Mean full natural flow (in acre-feet)	
N. F. Mattole River at Petrolia	113,000	
Ungaged area in Cape Mendocino Subunit	557,000	
Ungaged Eureka Plain Subunit	269,000	
Unit Total		8,077,900

TABLE 40

RUNOFF OF MATTOLE RIVER NEAR PETROLIA

Location: Lat. 40° 18' 40", Long. 124° 16' 10" in NW 1/4 Sec. 11, T2S, R2W, HB&M, on right bank 0.2 mile downstream from Clear Creek, 1.3 miles upstream from North Fork, and 1.2 miles southeast of Petrolia.
Drainage area: 242 square miles.
Records available: October 1911 to December 1913, October 1950 to date.
Recorded extremes: Maximum discharge, 90,400 cfs (December 22, 1955); minimum discharge, 20 cfs (September 1, 2, 15-30, October 27-31, 1913).
Remarks: No regulation or diversion above station.

Recorded flows at this station were taken as full natural flows.

Seasonal flow estimates for 1910-11 and 1913-14 through 1949-50 were obtained by a graphic correlation of recorded flows with the seasonal precipitation, October through September, recorded at the U. S. Weather Bureau precipitation gage, "Upper Mattole."

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The natural accretion to the Eel River between the gages at Van Arsdale Dam, near Covelo, and at Scotia was used as a base station for this determination.

Recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 40 (CONTINUED)

RUNOFF OF MATTOLE RIVER NEAR PETROLIA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F 71100
LOCATION LAT 40-18-40N, LONG 124-16-10W
NW1/4 SEC. 11, T2S, R2W, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 242 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	3400	11500	26900	268000	147600	105600	84900	53400	22500	5200	3500	2500	735000
1912	1600	8300	11600	273500	115300	187000	85800	187100	34600	12500	7300	23400	948000
1913	4100	162600	87300	197000	40700	36300	65600	16700	7300	3700	1900	1800	625000
1914	1500	31400	181100	652900	156800	58900	95600	76000	10700	4300	4100	4700	1278000
1915	7700	179700	280800	334700	261600	195000	148300	26500	9100	5800	4900	6900	1461000
1916	5300	101900	132300	175900	152600	107200	99600	43000	13200	3900	3200	3900	842000
1917	800	8900	43500	54800	116000	58700	72500	21500	7300	2900	1700	1400	390000
1918	1400	8500	35900	25400	116500	101800	60600	12200	4100	1400	1000	1200	370000
1919	1100	20100	37800	275700	286400	213200	81200	30300	7400	3200	2300	1300	960000
1920	2100	3300	64000	14100	5500	86600	134100	24900	7700	4900	1900	1900	351000
1921	7600	446600	362900	247900	174600	99900	35100	19900	5200	2100	2200	2000	1406000
1922	1600	12200	72600	42500	168700	112700	90400	42800	10900	1900	2000	1700	560000
1923	200	12400	131500	132300	48700	19500	85900	16900	5900	2900	1900	1900	460000
1924	3300	600	24500	45600	100700	14000	10200	3000	400	200	200	300	203000
1925	32500	202100	162900	94000	443400	69200	193900	59400	18600	5100	3200	5700	1290000
1926	1700	13500	45900	59500	258800	38700	18200	15400	2900	1100	900	400	457000
1927	5800	333900	200700	209800	414300	133500	109900	28700	10900	4700	2400	1400	1456000
1928	200	96800	55600	121100	81500	145000	124600	25800	6400	2500	900	600	661000
1929	1500	41900	82400	61100	90700	40500	59300	28300	13700	3900	1900	800	426000
1930	600	600	160300	139500	104800	77200	32000	21600	6400	2600	1700	1700	549000
1931	1300	7800	7100	111000	26600	68100	14800	5300	3500	1200	700	600	248000
1932	8300	54300	193100	161400	61500	54100	52300	46400	10200	4000	2300	1100	649000
1933	1200	4600	62200	168400	116500	287800	78400	103100	35200	9400	4400	2800	874000
1934	500	6700	129400	152900	71500	85500	42400	25400	8300	4200	2600	1600	531000
1935	3800	143000	68000	203500	49300	108900	148900	31200	7800	2800	1500	1300	770000
1936	2800	5700	44400	465400	225400	60400	56600	18300	17300	4700	2600	1400	905000
1937	1100	1000	3600	20600	193100	174400	163900	39900	21300	6300	2800	2000	630000
1938	4200	380000	257900	133900	349800	319400	78800	40900	13100	3900	2100	1000	1585000
1939	2700	24000	127500	70200	97100	99000	17100	13900	6200	2700	1700	900	463000
1940	1100	800	127200	348700	416100	249800	117400	28200	9500	4700	2900	2600	1309000
1941	4900	31100	363800	456900	234600	180700	178200	66600	24500	9800	6900	5000	1563000
1942	2000	18900	367300	208800	264900	35000	85300	76200	35000	10100	5600	2900	1112000
1943	1500	63700	134200	237700	61100	53900	45600	19600	14400	4000	2600	1700	640000
1944	13400	23100	19200	107600	95000	110900	43900	31300	16600	7000	4200	1800	474000
1945	1400	168200	167800	85700	220800	126200	56800	45300	17300	5700	3000	1800	900000
1946	2200	223300	446500	159500	67500	68900	32900	14300	5700	3100	2000	1100	1027000
1947	1700	61600	51200	15800	90400	145900	61100	12200	11900	3500	3200	1500	460000
1948	41300	43300	20600	232300	61300	112400	215300	89300	38400	11400	6900	7500	880000
1949	7300	34500	132800	68900	152400	287400	45700	21900	7600	4100	3100	1300	767000
1950	1500	8600	11900	220100	123400	142900	68200	31900	9300	3900	2600	1700	626000
1951	116800	113100	270500	272400	217400	87400	18300	30300	8800	4100	2300	1700	1143100
1952	12900	142300	315900	311900	220500	108800	28900	30400	10600	5900	3100	1900	1193100
1953	2600	7000	236900	442900	45700	116800	61100	84000	31600	10200	6400	4000	1049200
1954	11100	148200	99900	441900	159300	126100	130400	18300	8900	4500	4800	4700	1158100
1955	9400	71000	122400	112000	32800	27400	117500	35900	9800	5100	2700	2200	548200
1956	2400	31600	512800	353300	179900	87900	14100	15900	6700	3900	2300	1900	1212700
1957	17300	14300	11700	76600	165200	219700	63800	99000	21300	8000	3900	8100	708900
1958	71700	102700	199900	300800	595000	114400	174200	17800	8600	3900	2400	2600	1594000
1959	2700	15600	29200	337000	250700	49800	32500	10800	5100	3000	1800	7200	745400
1960	3400	2500	8700	107000	262100	208400	77600	113200	32800	7700	3900	2700	830000
TOTAL	438500	3649300	6744100	9810400	8392100	5818800	4009700	1970200	662500	237600	146400	144100	42023700
MEAN	8800	73000	134900	196100	167800	116400	80200	39400	13300	4800	2900	2900	840500
PERCENT	1.0	8.7	16.0	23.5	20.0	13.8	9.5	4.7	1.6	0.6	0.3	0.3	100.0

TABLE 41

RUNOFF OF NORTH FORK MATTOLE RIVER NEAR PETROLIA

Location: Lat. 40° 19' 35", Long. 124° 17' 35", in NE 1/4 Sec. 4, T2S, R2W, HB&M, on left bank 0.7 mile upstream from mouth and 0.5 mile west of Petrolia.
Drainage area: 38 square miles.
Records available: June 1951 to September 1957 (discontinued).
Recorded extremes: Maximum discharge, 9,600 cfs (December 21, 1955); minimum discharge, 2.0 cfs (September 4, 1955).
Remarks: Small diversions for irrigation above station.

Diversions above the station were not considered to be significant; therefore, recorded flows were taken as full natural flows.

Seasonal flow estimates for 1910-11 through 1950-51 and 1957-58 through 1959-60 were obtained by a graphic correlation of the existing record with the seasonal precipitation, October through September, recorded at the U. S. Weather Bureau precipitation gage, "Upper Mattole."

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The natural accretion to the Eel River between the gages at Van Arsdale Dam, near Covelo, and at Scotia was used as a base station for this determination.

Recorded and estimated full natural flows for this station are tabulated on the following page.

TABLE 41 (CONTINUED)

RUNOFF OF NORTH FORK MATTOLE RIVER NEAR PETROLIA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F72100
LOCATION LAT 40-19-35N, LONG 124-17-35W
NE1/4 SEC. 4, T2S, R2W, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 38 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	700	1800	3900	33500	20600	13800	11100	7200	2900	800	500	300	97100
1912	300	1200	1600	33200	15600	23700	10900	24300	4300	1900	1100	2900	121000
1913	900	25100	12500	24400	5600	4700	8500	2200	900	600	300	200	85900
1914	300	4700	25400	79500	21400	7500	12200	10000	1400	700	600	600	164300
1915	1600	26600	38700	40200	35100	24500	18600	3400	1100	900	700	800	192200
1916	1100	14800	17900	20600	20100	13200	12300	5500	1600	600	500	500	108700
1917	200	1700	7600	8300	19800	9400	11500	3500	1100	600	300	200	64200
1918	400	1600	6400	3900	20200	16600	9900	2000	700	300	200	200	62400
1919	200	3000	5200	33000	38300	26700	10200	3900	900	500	300	200	122400
1920	600	700	11800	2300	1000	14600	22500	4300	1300	1000	400	300	60800
1921	1500	63300	47900	28400	22400	12000	4200	2500	600	300	300	200	183600
1922	400	2000	10900	5600	24700	15400	12400	6000	1500	300	300	200	79700
1923	0	2200	21400	18800	7700	2900	12800	2600	900	500	300	300	70400
1924	1200	200	6100	9900	24300	3200	2300	700	100	0	100	100	48200
1925	6500	28400	21300	10700	56400	8200	23100	7300	2200	700	400	700	165900
1926	400	2300	7400	8300	40200	5600	2700	2300	400	200	200	100	70100
1927	1200	48300	27000	24600	54300	16400	13500	3600	1300	700	300	200	191400
1928	0	14900	8000	15100	11400	19000	16300	3500	800	400	100	100	89600
1929	400	7400	13600	8800	14600	6100	8900	4400	2000	700	300	100	67300
1930	100	100	24500	18400	15500	10700	4400	3100	900	400	300	200	78600
1931	500	1900	1600	22200	6000	14300	3100	1100	700	300	200	100	52000
1932	1800	8300	27400	19900	8500	7000	6800	6200	1300	600	400	100	88300
1933	200	700	8600	20300	15800	36600	9900	13400	4400	1500	700	300	112400
1934	100	1100	20000	20600	10800	12100	6000	3700	1200	700	400	200	76900
1935	800	21200	9400	24600	6600	13700	18700	4000	1000	400	200	200	100800
1936	600	900	6200	56700	30700	7700	7200	2400	2200	700	400	200	115900
1937	300	200	500	2600	27600	23300	21900	5500	2800	1000	400	300	86400
1938	900	56000	35500	16000	46800	40000	9900	5300	1600	600	300	100	213000
1939	700	4100	20300	9700	15000	14400	2500	2100	900	500	300	100	70600
1940	200	100	17600	42000	56200	31600	14800	3700	1200	700	400	300	168800
1941	1100	4800	52000	56600	32600	23500	23200	8900	3200	1600	1100	600	209200
1942	400	2700	48900	24200	34300	4300	10300	9500	4200	1500	800	300	141400
1943	300	9900	19500	30200	8600	7100	6000	2700	1900	600	400	200	87400
1944	3300	3900	3100	14900	14700	16100	6400	4700	2400	1200	700	300	71700
1945	300	23800	22100	9800	28200	15200	6800	5600	2100	800	400	200	115300
1946	400	30900	57600	17900	8500	8100	3900	1700	700	400	300	100	130500
1947	400	10600	8200	2200	14000	21200	8900	1800	1700	600	600	200	70400
1948	8500	6300	2800	27300	8100	13900	26500	11300	4700	1700	1000	900	113000
1949	1500	5100	18300	8200	20400	36300	5700	2800	900	600	500	200	100500
1950	300	1400	1800	28700	18000	19500	9300	4500	1300	700	400	200	86100
1951	24800	13300	28700	34700	21900	7100	1900	2300	500	400	200	300	136100
1952	1700	18600	43300	41800	24700	12100	3800	4100	1400	700	400	400	153000
1953	500	1900	27100	45700	10000	17900	7000	10600	3900	1500	900	600	127600
1954	800	23600	13900	44800	24400	15100	10800	2500	1600	700	600	500	139300
1955	900	8800	26500	15000	4500	4200	14500	4300	1400	1000	400	400	81900
1956	500	6600	68000	52500	28800	12600	2300	2400	1100	600	300	300	176000
1957	3300	1800	2900	12300	17600	23300	10400	16300	2500	1200	700	800	93100
1958	14800	18700	24900	30200	70400	20800	29600	3900	1600	700	400	300	216300
1959	600	2300	3200	42400	37700	8700	6000	1700	700	500	200	700	104700
1960	500	400	600	6100	38100	21100	6800	9200	3000	1100	600	300	87800
TOTAL	89000	540200	939600	1207600	1158700	763000	529200	260500	85000	37200	22100	18100	5650200
MEAN	1800	10800	18800	24100	23200	15300	10600	5200	1700	700	400	400	113000
PERCENT	1.6	9.6	16.6	21.3	20.5	13.5	9.4	4.6	1.5	0.6	0.4	0.4	100.0

TABLE 42

RUNOFF OF EEL RIVER BELOW SCOTT DAM NEAR POTTER VALLEY

Location: Lat. 39° 24' 30", Long. 122° 58' 15", in SE 1/4, Sec. 15, T18N, R10W, MDB&M, on left bank 0.7 mile downstream from Scott Dam and 9.7 miles northeast of the town of Potter Valley.
Drainage area: 290 square miles.
Records available: October 1922 to date. Prior to October 1953, published as "at Hullville."
Recorded extremes: Maximum discharge, 41,100 cfs (December 11, 1937); minimum discharge, 0.1 cfs (September 8, 1924).
Remarks: Flow regulated by Lake Pillsbury. No diversions above station.

Due to the regulatory effect of Lake Pillsbury, it was necessary to adjust the recorded flows to obtain full natural flows.

Adjusted monthly and seasonal full natural flows for the period 1922-23 through 1951-52 were taken from the June 1954 report published by the U. S. Geological Survey, "Surface Water Hydrology of Coastal Basin of California," Appendix B (Part 1), by Rantz.

Monthly and seasonal full natural flows for the period 1952-53 through 1959-60 were computed from recorded flows by personnel of the Department of Water Resources, using the same methods employed by Mr. Rantz of the USGS.

Seasonal full natural flows for the period 1907-08 through 1921-22 were obtained by a graphic correlation with full natural flows at Van Arsdale Dam. This correlation curve was used in the department's Bulletin No. 3 and was checked and used in the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959.

TABLE 42 (Continued)

Monthly full natural flows for 1916-17 through 1921-22 were calculated from monthly percentages of annual flows which were obtained from an "S" curve, "Accumulated mean monthly percent of seasonal runoff, 1922-23 through 1946-47." This was done by the old Hydrology Unit for the November 1959 report.

For ease of computation, the monthly full natural flows for 1910-11 through 1915-16 were taken as a direct ratio of the seasonal flow at "below Scott Dam" to the seasonal flow at "Van Arsdale Dam" times the monthly full natural flow at Van Arsdale Dam. Spot checks for various months of the years 1917-21 show this method to be generally within one percent of results obtained from the "S" curve.

Estimates of monthly and seasonal full natural flows for this station are tabulated on the following page.

TABLE 42 (CONTINUED)

RUNOFF OF EEL RIVER BELOW SCOTT DAM, NEAR POTTER VALLEY

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F61550
LOCATION LAT 39-24-30N, LONG 122-58-15W
SE1/4 SEC. 15, T18N, R10W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 290 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	800	3600	10100	77800	63500	108300	68900	29200	15100	2800	1000	900	382000
1912	1100	1700	2200	31100	16800	32400	25300	47700	11900	2600	900	2300	176000
1913	1500	29000	31500	103300	39400	29100	46600	20600	7700	2700	1200	400	313000
1914	600	9500	103500	367900	150400	83100	47700	18600	9400	2700	900	700	795000
1915	2000	1900	12200	94500	234600	93700	70100	74900	26200	5200	2000	700	618000
1916	1000	3700	59600	151000	169600	105200	30800	15100	6200	2800	1200	800	547000
1917	1000	3000	18800	25200	122300	54100	68600	30200	9100	2000	1000	700	336000
1918	700	1500	8100	5700	37000	51900	28100	8000	2000	700	600	700	145000
1919	1000	4800	6600	61400	122100	85200	40700	16900	3800	1100	700	700	345000
1920	600	900	8800	2800	1900	18600	57100	9500	1800	600	200	200	103000
1921	1200	89500	125700	134600	114500	69400	30800	16600	7700	1800	600	600	593000
1922	200	2300	13000	11400	77300	42200	45100	24800	8000	2300	900	500	228000
1923	4400	10300	52800	43900	24700	16500	56000	11400	4200	1700	700	600	227200
1924	1400	4000	1800	8200	23300	3700	2800	2400	800	400	200	200	49200
1925	3600	16400	42200	25400	181900	36400	66900	44000	14800	2700	1100	600	436000
1926	1800	4000	7800	21000	105700	17300	41400	7600	1700	800	400	300	209800
1927	1400	57200	61300	82200	210600	71300	83000	22800	7000	2000	800	400	600000
1928	2500	19400	17700	51900	62700	121200	66300	14700	4100	1500	700	300	363000
1929	400	5500	17900	10200	29300	14000	14800	8300	3100	1500	700	300	106000
1930	200	200	71000	55700	50700	58900	28000	13400	3400	1200	600	300	283600
1931	300	1600	1700	33000	14400	28100	7000	2900	1800	700	300	200	92000
1932	1200	5400	70900	52000	25500	32900	19500	20600	4200	1100	500	300	234100
1933	200	2000	7900	15300	21300	70600	28600	26900	10100	2600	1000	500	187000
1934	2100	1600	49300	33600	33500	25400	13700	6500	1900	700	400	200	168900
1935	900	22700	13400	59900	41600	58000	99700	20000	3800	1300	600	400	322300
1936	400	500	6400	143100	143300	44000	37400	10800	8600	3000	1100	500	399100
1937	300	200	1400	2100	45900	73900	60000	23200	7000	2200	900	400	217500
1938	600	74200	158600	71000	226200	265100	97800	45500	13100	1700	1200	500	955500
1939	1800	5300	20200	17800	22100	40500	11100	6200	2000	800	400	200	128400
1940	400	500	25200	137500	232700	136300	50000	15500	4400	1400	600	300	604800
1941	1000	3400	137900	191000	151100	123900	121900	38300	12300	3600	1100	600	786100
1942	800	3500	145400	137000	172600	26700	64100	37500	15300	3000	1300	600	607800
1943	600	17900	63500	162400	54300	60600	31800	15800	5800	2000	900	400	416000
1944	200	1300	3900	20700	27100	59300	23400	17100	5600	1700	700	400	161400
1945	800	25900	44800	19900	90700	43400	33800	14300	5500	1700	700	400	281900
1946	5800	35400	180700	75400	29000	28900	24100	9800	1800	900	500	300	392600
1947	200	15800	19800	3600	40800	70800	21500	4200	4700	1700	700	400	184200
1948	9800	4200	3900	61700	14700	41100	124700	44400	14300	2000	1000	800	322600
1949	700	3500	12300	10500	37800	109500	44200	17100	3200	1200	600	300	240900
1950	300	2200	1900	56500	75300	66700	46000	18400	5300	1500	600	400	275100
1951	23800	52000	136100	126600	102700	40800	17400	21500	4800	1600	700	400	528400
1952	200	34200	131200	97400	165700	84100	66700	31900	10400	2800	1100	600	626300
1953	900	3900	110400	274900	31100	55000	48200	33400	16800	4800	2600	1100	583100
1954	1600	15100	16400	147800	99400	76600	81100	13900	7000	2200	1000	500	462600
1955	300	17500	45000	23000	16900	19100	29300	27700	6300	2100	900	500	188600
1956	400	4900	265800	253400	172600	66400	31900	27100	8700	2600	1100	600	835500
1957	1700	3000	2400	23900	94000	83200	28500	50400	9400	2800	1100	2100	302500
1958	32700	18500	71800	131800	350000	123500	131200	36500	11900	4500	1600	700	914700
1959	700	1900	3800	82600	84300	39400	18700	6400	2200	900	500	300	241700
1960	700	1200	2100	25000	140700	112700	25000	18700	7700	2400	1000	500	337700
TOTAL	118800	647700	2426700	3855600	4595600	3219000	2357300	1099200	363900	100600	43100	27600	18855100
MEAN	2400	13000	48500	77100	91800	64400	47100	22000	7300	2000	900	600	377100
PERCENT	0.6	3.4	12.9	20.4	24.5	17.1	12.5	5.8	1.9	0.5	0.2	0.2	100.0

TABLE 43

RUNOFF OF POTTER VALLEY POWER HOUSE TAILRACE NEAR POTTER VALLEY

Location: Lat. 39° 21' 35", Long. 123° 07' 35", in NW 1/4 Sec. 6, T17N, R11W, MDB&M, on right bank 100 feet downstream from powerhouse and 3 miles northwest of the town of Potter Valley.
Records Available: December 1909 to date.
Remarks: Water is diverted from Eel River at Van Arsdale Dam. After passing through powerhouse, part of it is used for irrigation in Potter Valley and remainder flows into East Fork Russian River. Water for irrigation diverted from tailrace is included in records of discharge.

This station has recorded monthly and seasonal flows from December 1922 to date. In addition, flows have been computed from records of power output for December 1909 through November 1922. These records are a direct measurement of the water diverted from the Eel River at Van Arsdale Dam, through the Potter Valley Powerhouse, into the Russian River watershed.

Monthly and seasonal flows for this station are tabulated on the following page.

TABLE 43 (CONTINUED)

RUNOFF OF POTTER VALLEY POWERHOUSE TAILRACE, NEAR POTTER VALLEY

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F61970
LOCATION LAT 39-21-35N, LONG 123-07-35W
NW1/4 SEC. 6, T17N, R11W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET

EAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
911	900	4300	10400	12000	14600	16100	15500	16200	14100	3300	1100	1000	109500
912	1300	2000	2700	12900	14900	15900	15500	15900	12400	3200	1000	2900	100600
913	1800	13400	13100	15900	14000	15700	15300	15600	9400	3200	700	400	118500
914	600	5900	13400	14800	14300	15400	15300	15800	10400	3000	900	700	110500
915	2200	2100	11700	15200	13400	15700	15300	15800	15000	5900	2200	700	115200
916	1100	4100	15300	15900	14900	15900	15800	15400	7200	3200	1300	700	110800
917	1000	3200	13000	16500	14700	16500	15900	16700	10700	2200	1200	700	112300
918	800	1700	5600	7400	13400	17000	16100	9600	2500	800	500	800	76200
919	1000	5400	7600	12900	15000	17000	14800	14700	4500	1300	700	500	95400
920	600	1100	8700	3600	2300	13800	16600	11000	2300	700	100	200	61000
921	1400	9700	15900	15200	13800	15100	14600	15400	9000	2000	700	600	113400
922	200	1700	7800	16400	15200	16700	16300	17100	16300	18600	19400	18500	164200
923	18100	13600	14700	16300	14700	16300	15700	16300	16400	14800	13500	13200	183600
924	14900	13100	7100	4700	7100	4300	3500	3800	3600	3600	3600	1700	71000
925	4600	16200	18800	18100	15300	18000	16500	17500	17500	18200	16400	16200	193300
926	15800	14800	15300	13200	13100	15500	14600	15300	14900	15200	16000	15200	178900
927	15300	14900	15300	14400	13600	14800	14800	15300	15600	16200	16800	16400	183400
928	14800	14500	15300	15400	14300	15200	15100	16000	16400	17100	17800	16100	188000
929	14000	11800	13300	13500	11700	12400	10200	9200	11700	11500	11600	8600	139500
930	5600	4700	9300	16200	12600	12400	13900	14300	10900	11700	12800	9200	133600
931	5000	10500	15800	16600	15600	16800	10000	5900	5300	6600	7000	9500	124600
932	13800	16100	9500	16900	15400	8100	10800	13500	5400	6800	6800	6400	129500
933	11100	17600	17800	8900	14200	18000	17900	13600	11500	14200	17700	9900	172400
934	1400	600	200	4400	8500	3300	3900	7500	9200	10400	10800	10800	71000
935	11400	10900	11200	11400	10300	11200	8200	7800	7800	10700	10400	10700	122000
936	4700	7900	11100	11200	10400	11100	8900	10000	10500	12300	11700	9800	119600
937	11200	7800	11400	10900	10100	11000	10900	11000	10900	11300	11400	11100	129000
938	11500	7800	9900	9900	9800	4600	9400	11300	11100	11800	11400	11000	119500
939	10700	11000	11100	8700	9700	8300	9800	11200	11000	11600	11400	11800	126300
1940	12200	9200	10100	12000	10600	10800	11600	8900	6800	9300	8600	10900	121000
1941	11000	9900	10100	8100	9400	12800	11600	12500	11700	9200	12100	12800	131200
1942	11700	12700	13000	13100	11800	13200	12800	13100	12300	9100	8400	8400	139600
1943	8600	10300	13100	12800	11800	12800	12700	12500	8500	9200	9600	9100	131000
1944	9400	12600	3100	900	12300	13200	12700	13200	12600	10100	10300	9900	120300
1945	10000	12800	13400	13400	12100	13400	13100	13100	10200	10300	11100	12000	144900
1946	13400	13000	11700	12400	12200	13600	13400	11000	9600	10000	10000	9400	139700
1947	10300	10000	13200	11300	9700	13300	12900	5500	6500	8000	9200	11400	121300
1948	13300	12800	13500	13300	12600	13600	13000	13300	11300	6300	11300	13000	147300
1949	11000	11600	10800	13400	12100	13200	13000	12200	5100	8700	9900	9500	130500
1950	9400	11700	13500	13500	10000	0	9500	16300	4900	12300	10800	13300	125200
1951	16700	18300	17300	18600	16900	19200	19400	15800	10900	11300	11300	10900	186600
1952	12500	15400	18700	18800	16300	19200	19200	20200	17100	14000	19200	15000	205600
1953	13600	8800	18600	5200	11000	18900	19100	20000	19300	19300	19700	17200	190700
1954	17100	18100	18600	18000	14200	16400	18500	19500	12200	12500	13500	17800	196400
1955	19200	14700	18000	18900	17200	10700	10200	17900	12700	14800	4700	4000	163000
1956	14500	12600	8400	16600	16600	19700	19100	19400	12300	14700	15300	15300	184500
1957	14300	11600	6500	10000	9200	18000	14800	18500	12900	13100	13400	13600	155900
1958	14600	18000	18400	18100	14800	18200	17600	15800	13900	13300	3000	15900	181600
1959	17300	14300	6900	17000	16800	17900	9200	5400	16400	19100	19400	6100	165800
1960	0	9900	1500	5800	17200	18400	17200	15100	10100	18800	6400	10300	130700
TOTAL	456900	516700	590700	640600	641700	698600	681700	677900	540800	504800	474100	461100	6885600
MEAN	9100	10300	11800	12800	12800	14100	13600	13600	10800	10100	9500	9200	137700
PERCENT	6.6	7.5	8.6	9.3	9.3	10.2	9.9	9.9	7.8	7.3	6.9	6.7	100.0

TABLE 44

RUNOFF OF EEL RIVER AT VAN ARSDALE DAM NEAR POTTER VALLEY

Location: Lat. 39° 23' 25", Long. 123° 06' 55", in NE 1/4 Sec. 30, T18N, R11W, MDB&M, on left bank 500 feet downstream from Van Arsdale Dam and 5 miles north of the town of Potter Valley.
Drainage area: 349 square miles (revised in 1961; previous area of 347 square miles was used in computations for this report).
Records available: November 1909 to date.
Recorded extremes: Maximum discharge, 48,600 cfs (December 22, 1955); no flow on November 1, 1945 and September 13 and 14, 1953.
Remarks: Flow regulated by Lake Pillsbury. Diversion from Van Arsdale Reservoir through tunnel to Potter Valley Powerhouse.

The recorded flows at this station were adjusted to correct for: (1) regulation at Lake Pillsbury, and (2) diversion to Potter Valley Powerhouse, to obtain full natural flows. Since all incremental flows below Van Arsdale Dam were taken as full natural flows, the adjustment factors derived for this station were used to convert recorded flows to full natural flows to all downstream gages on the mainstem Eel River. Recorded flows at the gages above Dos Rios, below Dos Rios, at Alderpoint, and at Scotia were adjusted in this manner. Estimates of seasonal full natural flows for 1907-08 through 1909-10 and monthly natural flows for 1909-10 were taken from the USGS report, "Surface Water Hydrology of the Coastal Basins of California," by Rantz. Adjusted seasonal and monthly natural flows for 1910-11 through 1957-58 were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. Recorded flows for 1958-59 through 1960-61 were adjusted by the same method as that used for the Hydrology Unit's report.

TABLE 44 (Continued)

Monthly and seasonal full natural flows for this station are tabulated on the following page.

TABLE 44 (CONTINUED)

RUNOFF OF EEL RIVER AT VAN ARSDALE DAM, NEAR POTTER VALLEY

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F61450
LOCATION LAT 39-23-25N, LONG 123-06-55W
NE1/4 SEC. 30, T18N, R11W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 349 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	1000	4400	12300	94900	77400	132000	84000	35600	18400	3400	1200	1100	465700
1912	1400	2200	2800	40100	21700	41900	32700	61500	15400	3300	1100	3000	227100
1913	1900	35900	39000	128000	48800	36100	57700	25500	9500	3300	1500	500	387700
1914	700	10700	117000	416000	170000	94000	53900	21000	10600	3100	1000	800	898800
1915	2300	2200	14200	110000	273000	109000	81600	87100	30500	6000	2300	800	719000
1916	1200	4400	70300	178000	200000	124000	36300	17800	7300	3300	1400	900	644900
1917	1100	3700	23300	31900	152000	67900	83500	35300	11200	2300	1400	800	414400
1918	900	1800	10700	7600	47000	69200	35800	9700	2600	900	700	900	187800
1919	1200	5800	8100	75800	153000	104000	48400	19800	4600	1500	800	700	423700
1920	800	1200	11400	3800	2400	23300	74300	11600	2400	800	300	300	132600
1921	1500	105000	144000	166000	132000	78800	34200	18600	9100	2100	800	700	692800
1922	400	3000	16700	14300	98000	55000	56800	30700	9400	3000	1200	600	289100
1923	5200	12700	72000	58400	38900	17800	62700	12000	6000	2000	900	700	289300
1924	1600	4300	2300	9600	28700	3800	3000	2400	1000	500	300	200	57700
1925	4800	20100	55100	32000	203300	41600	85100	54500	14800	2900	1300	600	516100
1926	2000	4200	8600	25200	130200	21500	53700	9200	2500	1000	500	400	259000
1927	1500	64500	82500	149500	300300	85000	99000	27100	7900	2200	900	500	82090
1928	2600	20100	20800	62700	72900	154100	83200	16300	4400	1700	800	400	44000
1929	500	8400	23200	15300	37600	17700	19000	10100	5400	1800	800	400	14020
1930	300	700	83900	73700	65800	71300	32600	14400	3700	1400	600	400	34880
1931	400	2200	2100	40000	16700	34700	8400	3000	1800	800	400	300	11080
1932	1200	6000	96300	64400	32200	35600	23000	24000	5000	1300	600	400	29000
1933	200	2100	9300	20500	28600	88600	32500	32000	11000	3100	1200	600	22970
1934	2200	1900	58100	42000	39900	30900	15900	7800	2000	900	500	300	20240
1935	1300	27200	17200	77400	48400	77400	124700	23300	5000	1600	800	400	40470
1936	1300	1800	9600	189900	180900	52200	45200	12600	11200	3500	1200	600	51000
1937	300	800	2200	3300	59800	92200	73200	25300	8700	2600	1100	500	27000
1938	1900	92700	187000	75800	247600	279100	107700	46400	13800	3000	1400	600	105700
1939	3200	7200	28000	22900	29200	47600	12600	7600	2400	1000	500	300	16250
1940	400	1400	29100	156800	277100	159500	61400	16800	4700	1600	800	400	71000
1941	1100	3500	155700	197600	167300	143900	143600	44700	13700	4200	1400	700	87740
1942	1800	5200	169300	155400	201700	31300	72400	42200	17800	3200	1600	700	70260
1943	700	21500	75800	199600	66400	68200	39300	20200	7600	2400	1000	500	50320
1944	300	1900	4500	25700	34300	70100	24800	18000	6200	2000	900	400	18910
1945	900	31700	51400	25700	101900	54200	40900	16900	6100	2000	900	400	33300
1946	6800	42600	204200	93000	36600	37000	27900	10400	2700	1100	500	300	46310
1947	200	18900	23400	4600	49100	85100	26300	5300	6200	2000	900	400	22240
1948	12300	5600	5400	74400	20000	53200	145000	50800	16100	3200	1200	900	38810
1949	1300	5300	16200	14600	49900	131100	47900	17600	4000	1400	700	400	29040
1950	300	3000	3000	71300	83700	72400	51300	19500	5500	1800	800	400	31300
1951	28000	54800	157800	153700	121200	52700	20100	24900	5800	1900	800	400	62210
1952	300	35700	167500	127300	205800	100800	67200	37900	10900	3400	1300	600	75870
1953	400	3400	137200	322500	35200	66900	53900	41700	21200	5300	2700	1100	69150
1954	1700	17700	19600	180100	114400	85100	93700	17400	6700	2200	900	800	54030
1955	400	19700	52400	30100	20700	23100	35600	31300	6900	2200	900	500	22380
1956	300	5900	308600	268600	187800	70800	35500	30300	8200	2500	1000	1300	92080
1957	2100	3000	3000	31000	103200	94600	32900	57100	11000	3100	1200	2200	34440
1958	36600	22200	78000	144000	384000	140700	148400	38800	12500	4000	1400	700	101130
1959	400	1200	4400	95600	104500	44300	21200	7400	2100	1000	500	900	28350
1960	900	500	2200	32400	171800	138600	29300	21200	7300	2300	1000	500	40800
TOTAL	142100	761900	2896700	4633000	5472900	3809900	2779300	1272600	420800	117100	49900	33200	2238940
MEAN	2800	15200	57900	92700	109500	76200	55600	25500	8400	2300	1000	700	44780
PERCENT	0.6	3.4	12.9	20.7	24.5	17.0	12.4	5.7	1.9	0.5	0.2	0.2	100.

TABLE 45

RUNOFF OF EEL RIVER ABOVE DOS RIOS

Location: Lat. 39° 41' 20", Long. 123° 21' 30", in SW 1/4 Sec. 7, T21N, R13W, MDB&M, on left bank 1.8 miles upstream from Middle Fork and 2.1 miles south of Dos Rios.
Drainage area: 705 square miles (revised in 1961; previous area of 703 square miles was used in computations for this report).
Records available: December 1950 to date.
Recorded extremes: Maximum discharge, 123,000 cfs (December 22, 1955); minimum discharge, 0.8 cfs (September 11, 1955).
Remarks: Flow regulated by Lake Pillsbury and by diversion to Potter Valley Powerhouse.

The recorded flows at this station were adjusted to obtain natural flows by applying the correction factors derived for the gage at Van Arsdale Dam. Where possible, full natural flows for the required period were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. Data for missing intervals were computed using the same method as was used in the report.

The accretions to the Eel River between Van Arsdale Dam and the gage above Dos Rios were taken as full natural flows. Seasonal natural flows for 1907-08 through 1950-51 were obtained from a least squares correlation of this accretion with the natural runoff between Van Arsdale Dam and the gage at Scotia.

Let: X = incremental natural flows between Van Arsdale Dam and Scotia

Y = incremental natural flow between Van Arsdale and "above Dos Rios"

Z = full natural flow at Van Arsdale Dam

Then: Y = -48,400 + 0.1260 X, and the seasonal full natural flow at "above Dos Rios" equals Y plus Z.

TABLE 45 (Continued)

The monthly distribution of the seasonal accretion between Van Arsdale Dam and the gage above Dos Rios was determined in accordance with the distribution of runoff between the gages Eel River at Scotia, Middle Fork Eel River near Covelo, and Eel River at Van Arsdale Dam. To express this distribution mathematically, let:

a = monthly natural flow at the gage above Dos Rios

b = seasonal accretion between Van Arsdale Dam and gage above Dos Rios

c = seasonal natural runoff between Covelo, Van Arsdale, and Scotia

d = monthly natural runoff between Covelo, Van Arsdale, and Scotia

e = monthly natural flow at Van Arsdale Dam

Then: $a = \left(\frac{b \times d}{c}\right) + e$

The area above the gate near Covelo was eliminated in computing monthly flows to correct the influence of snowmelt runoff.

Monthly and seasonal estimates of full natural flows for this station are tabulated on the following page.

TABLE 45 (CONTINUED)

RUNOFF OF EEL RIVER ABOVE DOS RIOS

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F61350
LOCATION LAT 39-41-20N, LONG 123-21-30W
SW1/4 SEC. 7, T21N, R13W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 705 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	2400	8200	26600	244400	173700	199000	131600	62600	29600	5500	2300	1800	887700
1912	1900	4100	7200	149300	75600	126900	67200	129100	27800	7000	2700	7300	606100
1913	5000	133700	124600	331700	97900	78700	125800	41100	16200	6100	2600	1300	964700
1914	1500	24100	243000	894300	304200	143100	124200	71400	17600	5400	2600	2400	1833800
1915	5900	68500	183400	322200	466800	249700	176000	102300	35700	8700	4000	2800	1626000
1916	5200	62100	193000	350100	373700	242600	134000	55500	18500	5700	3000	2500	1445900
1917	1500	9500	68600	91900	299900	140600	163000	56600	18300	4500	2300	1700	858400
1918	1500	4600	29200	21400	121000	132300	68900	15900	4500	1500	900	1100	402800
1919	1800	12000	27900	228200	338200	238100	93600	35100	8500	2600	1400	1300	988700
1920	1300	1900	31000	8400	4400	55200	117700	18900	4700	1900	600	600	246600
1921	5300	283600	380800	336300	272100	156900	58400	31000	12300	3100	1600	1400	1542800
1922	1200	7600	61700	42000	226500	138500	116000	56000	15700	3900	1900	1100	672100
1923	5300	16900	144000	134700	71700	30600	112400	20800	9000	3200	1500	1200	551300
1924	2200	4400	8100	21100	58300	7800	5600	3100	1100	500	300	200	112700
1925	19800	94200	152500	91200	529300	91100	207700	88300	25200	5200	2400	2200	1309100
1926	2800	9500	37900	65100	333100	51000	66000	18500	4200	1600	800	500	591000
1927	4100	182200	198100	276600	593500	177000	165900	42800	13800	4300	1700	900	1660900
1928	2700	61600	59700	151900	143000	275700	175400	33500	8600	3100	1200	600	917000
1929	900	18500	55500	40500	81500	36800	43600	20700	10500	3000	1200	500	313200
1930	600	900	179000	160800	142200	126100	52700	26600	7300	2500	1200	900	700800
1931	900	4700	5800	101600	33900	77600	16700	5700	3600	1300	600	400	252800
1932	4800	24800	205400	160300	74900	72200	54200	49000	10400	3000	1300	700	661000
1933	600	3200	34000	90900	85600	225500	65500	71000	24100	6000	2200	1100	609700
1934	2400	3600	112600	109700	77000	74000	34800	18000	5300	2300	1100	600	441400
1935	3400	89300	65400	229300	91400	169800	236300	44300	10200	3100	1400	800	944700
1936	2600	4000	37100	493300	352400	96900	82200	23400	21300	5700	2100	1000	1122000
1937	700	1100	4100	14600	182900	200400	163100	45000	19100	5100	1900	1000	639000
1938	4300	265000	377900	180000	565800	562000	169400	75200	22900	5200	2300	1000	2231000
1939	4300	15200	97000	62900	93900	111800	22400	14800	5600	2100	1000	500	431500
1940	800	1600	96600	351700	548900	318300	127300	31100	9400	3500	1700	1100	1492000
1941	3100	13600	348200	452100	319900	258300	243300	78300	25900	8200	3500	2000	1756400
1942	2800	13100	418600	304500	422700	59800	133600	91400	40100	8500	3800	1700	1500600
1943	1700	57800	200700	432600	136300	128200	84200	37600	20200	5300	2400	1200	1108200
1944	4600	7800	12600	73300	83400	125800	44300	30500	12800	4300	1900	800	402100
1945	1500	89400	145300	76200	253800	138800	74500	41000	15200	4500	1900	900	843000
1946	7900	134100	502900	205300	92200	92200	51200	19500	6300	2700	1200	600	1116100
1947	900	38800	50400	13400	107800	177100	60400	11400	12100	3400	1900	800	478400
1948	30100	20400	16900	211000	62100	128400	272200	98300	36300	8100	3400	2900	890100
1949	4200	16200	84900	52200	147100	309500	72900	28400	7700	3000	1600	700	728400
1950	1000	6300	10400	216200	178500	179400	96400	38500	11000	3700	1700	900	744000
1951	100700	99100	324700	398800	281900	107000	32900	38200	8700	3200	1600	1300	1398100
1952	2300	79400	458000	355900	388800	196100	94000	50800	15100	4900	1700	1000	1648000
1953	500	7700	354300	666100	54700	165500	95000	73000	37600	8200	3800	1600	1468000
1954	2600	56500	79200	453200	230500	176500	186600	27200	11000	3200	1500	1400	1229400
1955	1300	43200	131100	101600	42800	50200	99300	52000	10000	3100	1000	500	536100
1956	700	25100	723300	666400	465100	140600	49600	40800	11300	3300	1200	1400	2128800
1957	10300	7400	6300	96200	234000	243800	73200	124900	20500	5100	1800	4300	827800
1958	86400	73800	203400	329900	865600	289400	319700	51000	17700	5600	2000	1100	2245600
1959	900	4000	12000	234300	247300	74500	37600	11700	3400	1300	500	900	628400
1960	400	900	4300	83100	504900	361700	68300	54700	14300	3600	1100	600	1097900
TOTAL	361600	2215200	7335200	11178700	11932700	8009000	5366800	2306500	758200	209800	91300	67100	49832100
MEAN	7200	44300	146700	223600	238700	160200	107300	46100	15200	4200	1800	1300	996600
PERCENT	0.7	4.4	14.7	22.4	24.1	16.1	10.8	4.6	1.5	0.4	0.2	0.1	100.0

TABLE 46

RUNOFF OF MIDDLE FORK EEL RIVER BELOW BLACK BUTTE RIVER NEAR COVELO

Location: Lat. 39° 49' 35", Long. 123° 05' 30", in NW 1/4 Sec. 28, T23N, R11W, MDB&M, on right bank 0.2 mile downstream from Black Butte River and 8.6 miles east of Covelo.
Drainage area: 367 square miles.
Records available: August 1951 to date.
Recorded extremes: Maximum discharge 89,100 cfs (December 21, 1955); minimum discharge, 4.4 cfs (September 22-26, 1951).
Remarks: No regulation or diversion above station.

The recorded flows at this station were taken as full natural flows. Estimates of monthly and seasonal full natural flows for 1907-08 through 1950-51 were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. Methods used to derive these flow estimates are as follows.

The gage Middle Fork Eel River near Covelo, with records for 1911-12 through 1916-17, and 1920-21, was used as a base station. For correlation purposes, the base station record was extended by adjusting the record for the gage below Black Butte River by a factor of $\frac{0.138}{0.123}$ or 1.122. This factor was derived in the following manner. The ratio of the average natural flow at the Covelo gage to the average natural flow at the Scotia gage for common years of record is 0.138. The ratio of the average natural flow at the gage below Black Butte River to the average flow at the Scotia gage for the 1951-52 through 1957-58 is 0.123. Therefore, it was assumed that flows at the Covelo gage are $\frac{0.138}{0.123}$ or 1.122 times the flow at the Black Butte gage. A check of this ratio was made by a recomputation which included records for 1958-59 through 1960-61. This recomputation changed the ratio by less than 4 percent, so the original computations were used for this report.

A straight-line correlation of the extended record yielded:

$$Y = 5.222 + 0.1520\ X$$

Where: X = incremental seasonal natural flow between Van Arsdale and Scotia

Y = seasonal full natural flow at the Covelo gage

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using the gage Eel River at Van Arsdale Dam as the base station.

These estimates of monthly and seasonal natural flows were then readjusted to the gage below Black Butte River by multiplying by a factor of $\frac{0.123}{0.138}$ or 0.8913.

Recorded and estimated full natural flows for the gage below Black Butte River are tabulated on the following page.

TABLE 46 (CONTINUED)

RUNOFF OF MIDDLE FORK EEL RIVER BELOW BLACK BUTTE RIVER, NEAR COVELO

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F63100
LOCATION LAT 39-49-35N, LONG 123-05-30W
NW1/4 SEC. 28, T23N, R11W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 367 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	1500	6600	12200	73800	66700	132900	122700	58000	28000	4100	1000	1500	509000
1912	900	2300	1800	78000	75800	51900	62700	135200	29300	4500	1400	7200	451000
1913	3800	90700	77500	104600	63600	63000	124700	77500	18900	3200	1900	600	630000
1914	1100	9900	108300	350300	144800	164600	221100	70700	26500	5500	1100	1100	1105000
1915	4300	2600	10200	80800	211000	155700	155700	171100	50200	6800	1700	900	851000
1916	800	7000	138000	110800	213900	153400	81400	45700	17000	5400	800	800	775000
1917	500	6500	23300	35200	110400	69200	177500	89800	23800	3200	1100	500	541000
1918	500	2900	16200	23300	45700	100400	64900	20000	4800	1400	900	2000	283000
1919	2700	13200	12600	90600	203400	162000	109100	50900	11200	2700	600	2000	661000
1920	1100	1600	11200	2900	2100	23500	109100	19200	3600	1100	200	400	17600
1921	3700	175200	193800	152000	124200	108500	70500	72300	21300	3700	900	900	92700
1922	500	6100	23800	15900	121000	79400	119000	72400	21000	5100	1400	1400	46700
1923	8100	19200	75200	47700	35300	18800	96700	20500	10100	2700	700	1000	33600
1924	4500	11700	4400	14100	46900	7400	8500	7600	2900	1300	300	400	11000
1925	10900	45300	86100	39000	273700	67000	196600	141300	36200	6300	1800	1800	90600
1926	4500	9000	12700	29100	169400	33200	119300	23000	6200	2000	400	1200	41000
1927	2900	105000	92600	129900	292200	96500	164300	50600	14300	3800	1000	1900	95500
1928	4500	34600	23800	57300	74300	183700	143500	31800	7900	2800	1700	1100	56700
1929	1400	18800	35900	18600	50300	28000	43300	26000	13300	3400	1000	1000	24100
1930	400	1300	102600	69800	69800	88400	59000	28900	7300	2200	400	900	43100
1931	800	5900	3900	59300	27300	66900	23600	9200	5100	1800	600	600	20500
1932	2700	13100	143200	74300	41200	53900	50300	59300	11300	2300	500	900	45300
1933	500	5100	16700	27800	43200	155400	83500	92300	29700	6500	1400	1900	46400
1934	5000	4700	87900	49800	52500	47900	35500	19900	5000	1600	600	600	31100
1935	2500	52700	22900	80600	56500	105400	247000	52100	9500	3200	1300	1300	63500
1936	2900	2900	14300	218200	232300	77700	98400	31400	25700	6400	1400	1400	71300
1937	400	1800	3200	3600	72400	131800	151100	59000	18900	5000	1400	1400	45000
1938	3900	155300	214500	68400	246100	322500	182900	88200	25000	5300	1300	2600	131600
1939	9600	20500	55700	35600	50300	96100	37300	25300	7500	2400	700	1000	34200
1940	900	2700	38400	159000	311600	210700	117900	37500	9800	1800	900	1800	89300
1941	1000	5000	167700	165700	156700	157700	231400	80800	23000	6000	1000	2000	99800
1942	3600	9100	215000	154000	222300	41000	135700	88400	33700	5500	900	1800	91100
1943	700	44400	107700	219500	81700	97200	82400	47200	16900	4200	700	1400	70400
1944	800	3700	6200	27100	40000	96300	49600	40300	13000	3400	800	800	28200
1945	2400	76000	85000	33200	145900	91100	100700	47000	15100	4200	1200	1200	60300
1946	15900	96800	319600	113400	49900	59000	64300	26500	6800	1500	800	1500	75600
1947	300	36600	31100	4600	56900	115000	52000	12100	12800	3600	1000	1000	32700
1948	22000	9500	6500	70100	20800	65400	260500	101700	29800	4700	1200	1800	59400
1949	3600	12600	26300	18400	70500	216800	115200	47900	10000	3100	500	1100	52600
1950	500	6200	4600	87700	114600	116100	119900	50800	13400	3600	500	1100	51900
1951	57700	110100	218600	166000	145500	73700	40800	57700	11600	3600	900	1800	88800
1952	3100	36500	200800	84300	208700	110600	183200	115800	30800	7700	2000	1000	9845
1953	900	2700	80700	387800	70300	70700	125900	96500	63700	11700	2600	1300	9148
1954	2000	44900	48700	216600	157500	137200	149300	37100	12000	2700	1300	1100	8104
1955	1300	36800	67500	49600	38400	45800	46500	75000	11600	2400	700	400	3760
1956	600	23100	479800	364800	174900	118900	106700	106000	29500	5200	1300	700	14115
1957	12200	10000	8900	21500	160000	149600	68300	92200	19100	3000	1200	4900	5509
1958	63700	87800	125500	182700	440100	99700	152300	109200	30800	7300	2200	1100	13024
1959	800	6600	9900	148700	69800	84400	59800	19300	5400	1300	400	1600	4080
1960	900	800	2800	23900	227600	161500	50800	43200	15800	2700	900	500	5314
TOTAL	281800	1493400	3875800	4839900	6180000	5163500	5472400	2981400	906100	194900	52500	70200	315119
MEAN	5600	29900	77500	96800	123600	103300	109400	59600	18100	3900	1100	1400	6302
PERCENT	0.9	4.7	12.3	15.4	19.5	16.4	17.4	9.5	2.9	0.6	0.2	0.2	100

TABLE 47

RUNOFF OF EEL RIVER BELOW DOS RIOS

Location: Lat. 39° 44' 15", Long. 123° 22' 15", in NE 1/4 Sec. 25, T22N, R14W, MDB&M, on left bank 2.2 miles downstream from Middle Fork and 1.7 miles northwest of Dos Rios.
Drainage area: 1,484 square miles (revised in 1961; previous area of 1,462 square miles was used in computations for this report).
Records available: October 1911 to December 1913, October 1951 to date.
Recorded extremes: Maximum discharge, 283,000 cfs (December 22, 1955); minimum discharge, 5.2 cfs (September 13, 1955).
Remarks: Flow partially regulated by Lake Pillsbury and by diversion to Potter Valley Powerhouse.

The recorded flows at this station were adjusted to obtain full natural flows by applying the correction factor derived for the gage at Van Arsdale Dam. Adjusted recorded flows, estimates of seasonal flows for 1907-08 through 1910-11 and 1913-14 through 1950-51, and estimates of monthly flows for 1920-21 through 1946-47 were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. Recorded flows for 1958-59 through 1960-61 were adjusted and estimates of flows for 1910-11, 1913-14 through 1919-20, and 1947-48 through 1950-51 were computed using the same methods as were used in the Hydrology Unit office report. These methods are described below.

Accretions to the Eel River between Van Arsdale Dam and the gage below Dos Rios were taken as natural flows. A straight-line correlation of seasonal flows by least squares yielded:

$$Y = 258{,}400 + 0.3914\ X$$

Where: X = incremental full natural flow between Van Arsdale Dam and the gage at Scotia

TABLE 47 (Continued)

Y = incremental full natural flow between Van Arsdale Dam and the gage below Dos Rios

If: Z = full natural flow of Eel River at Van Arsdale Dam, then the seasonal full natural flows at the gage below Dos Rios equals Y plus Z

The monthly distribution of the estimated seasonal flows was determined as follows:

Let: a = monthly natural flow at the gage below Dos Rios

b = seasonal natural accretion between gages above Dos Rios, near Covelo, and below Dos Rios

c = seasonal natural runoff between gages at Van Arsdale Dam, near Covelo, and at Scotia

d = monthly natural runoff between gages at Van Arsdale Dam, near Covelo, and at Scotia

e = monthly natural flow at gage near Covelo

f = monthly natural flow at gage above Dos Rios

Then: $a = \frac{(b \times d)}{c} + e + f$

Adjusted recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 47 (CONTINUED)

RUNOFF OF EEL RIVER BELOW DOS RIOS

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F61300
LOCATION LAT 39-44-15N, LONG 123-22-15W
NE1/4 SEC. 25, T22N, R14W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 1484 SQ. MILES

EAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
911	4800	17400	47500	402500	296800	381800	293100	141200	66700	11200	3900	3800	1670700
912	2600	6600	10500	295000	169100	246600	174400	315900	64200	10500	2600	13100	1311100
913	8200	307700	267000	631700	181400	165100	273100	142700	44800	10200	4100	2000	2038000
914	3200	43400	440800	1576900	547800	357600	414800	181300	51600	13000	4800	4600	3639800
915	14000	133500	353100	611400	884700	556000	439000	308500	96800	18800	7500	5700	3429000
916	9600	120700	455500	626100	766600	518800	311200	139900	47500	13900	5300	4800	3019900
917	2300	19600	117000	161000	496700	254300	401300	167900	48500	9200	3900	2700	1684400
918	2300	8600	51900	50800	190200	260500	149700	39900	10400	3300	1900	3300	772800
919	5100	30500	53800	421100	677700	500100	243100	101300	23500	6300	2400	3800	2068700
920	2600	3900	49400	13000	7400	91100	252700	42600	9500	3400	900	1100	477600
921	12400	614600	776200	634900	516900	337300	155700	121400	38600	8100	3300	2800	3222200
922	2000	16600	109600	72900	423000	267100	277500	149100	42300	10200	3800	2900	1377000
923	14400	39600	250700	211800	121400	55600	236400	46500	21300	6600	2500	2500	1009300
924	7700	12400	22000	44500	130500	18700	16800	12000	4400	1600	1300	800	272700
925	42200	195300	315300	175100	1057900	200000	511500	269800	72900	13900	5200	5400	2864500
926	8300	21700	63700	113400	602400	99800	204600	48000	11800	4100	1500	2000	1181300
927	9100	382300	382600	511000	1125900	349500	396900	110600	34000	10000	3300	3300	3318500
928	5800	125200	107800	265200	264900	548700	387000	78500	19800	7000	3200	2000	1815100
929	2700	42000	103600	67500	148400	72700	98200	52400	26500	7100	2400	1700	625200
930	1200	2500	334000	275700	252600	248300	127400	64100	17000	5500	1900	2100	1332300
931	2000	12100	11200	184500	69100	164100	45300	16700	9700	3500	1400	1200	520800
932	9400	47900	414400	286200	140100	148900	124500	126700	25500	6400	2200	1800	1334000
933	1200	9400	64100	154700	160300	463300	174400	192700	63500	14600	4300	3500	1306000
934	8000	9300	226700	184500	146300	139800	79900	43200	11800	4500	2000	1400	857400
935	7400	185000	119300	408800	180100	342400	578900	115100	23900	7600	3200	2500	1974200
936	6600	8500	70300	928100	720600	212200	215800	65300	56300	14300	4300	2900	2305200
937	1400	3200	8400	23400	317600	395300	371700	119700	44800	11800	3800	2700	1303800
938	10500	568700	762100	335200	1081000	1136500	421000	195700	57900	12800	4500	4200	4590100
939	15500	40600	180600	115000	170000	239200	67300	45400	14900	5200	2000	1800	897500
940	2100	4800	185800	662900	1084000	663100	304500	82900	23700	6800	3300	3500	3027400
941	5600	26300	672600	818200	603900	516300	573700	192700	60300	17700	6100	5100	3498500
942	7700	28700	830800	579500	823800	125300	327900	224400	93200	18200	6300	4300	3070100
943	3200	130200	399500	824500	271500	274600	204500	101300	47000	11700	4100	3300	2275400
944	6700	13500	21700	116100	141200	248200	105000	79000	29000	8700	3100	1900	774100
945	4600	207600	294400	142200	504200	289200	206800	107600	37300	10600	3800	2600	1810900
946	26400	301400	1053100	404600	183800	193600	138200	55000	16200	5400	2700	2600	2383000
947	1500	85500	92900	21000	188000	332100	128400	26800	28100	7800	3300	2000	917400
948	64900	39600	30800	367500	109400	244600	637400	239400	81200	16200	6000	6100	1843100
949	9800	36000	149300	91800	275300	642900	214800	87600	20800	7300	2700	2100	1540400
950	2000	15000	19500	389100	356000	364700	253500	105300	28900	8800	2800	2400	1548000
951	214900	252600	683300	751800	554500	226600	87400	112000	23700	8300	3100	3900	2922100
952	5200	128600	838400	629000	788100	407800	324400	188700	55700	14200	4000	1900	3386000
953	1600	12500	596900	1304800	147300	307900	250100	189600	112100	25500	7200	3500	2959000
954	5700	115600	128500	857000	492100	383900	414100	76500	28600	8100	3200	2900	2516200
955	3600	94900	251200	200400	105200	126300	177300	156700	24200	6900	1900	1100	1149700
956	1700	59900	1648400	1326800	846900	317900	195800	178800	47200	9800	3100	2600	4638900
957	25200	20300	17700	155900	500200	492400	177500	267500	50200	11000	3800	12000	1733700
958	186200	196200	436100	693000	1773700	545400	629200	195900	63300	15300	5200	2700	4742200
959	2300	13200	28200	499900	451900	202100	121200	38400	11000	2900	1100	3200	1375400
960	2400	2300	8100	127500	956700	583600	138900	114900	38300	7700	2200	1300	1983900
OTAL	805800	4813500	14556300	20745400	23005100	16259800	13053800	6275100	1980400	483500	172400	163400	102314500
EAN	16100	96300	291100	414900	460100	325200	261100	125500	39600	9700	3400	3300	2046300
ERCENT	0.8	4.7	14.2	20.3	22.4	15.9	12.8	6.1	1.9	0.5	0.2	0.2	100.0

TABLE 48

RUNOFF OF NORTH FORK EEL RIVER NEAR MINA

Location: Lat. 39° 56' 15", Long. 123° 20' 45", in SW 1/4 Sec. 8 T24N, R13W, MDB&M, on right bank 1.2 miles upstream from Asbill Creek and 2 miles south of Mina.
Drainage area: 250 square miles (revised in 1961; previous area of 251 square miles was used in computations for this report).
Records available: August 1953 to date.
Recorded extremes: Maximum discharge, 58,400 cfs (December 22, 1955); minimum discharge, 0.1 cfs (August 30, 31, 1959).
Remarks: No regulation or diversion above station.

The recorded flows at this station were taken as full natural flows.

Estimates of seasonal flows for 1907-08 through 1952-53 and monthly flows for 1920-21 through 1946-47 were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. Monthly flow estimates for 1910-11 through 1919-20 and 1947-48 through 1952-53 were computed using the same methods as were used in the previous report.

Estimates of seasonal flow were calculated from a straight-line least squares correlation as follows:

$$Y = -6{,}900 + 0.0806\ X$$

Where: X = incremental natural flow between gages at Van Arsdale Dam and at Scotia

Y = full natural flow at the gage near Mina

The monthly distribution of the estimated seasonal flows was determined in the following manner:

Let: a = monthly natural flow at the gage near Mina

b = seasonal natural flow at the gage near Mina

TABLE 48 (Continued)

c = seasonal natural runoff between the gages at Van Arsdale Dam, near Covelo, and at Scotia

d = monthly natural runoff between the gages at Van Arsdale Dam, near Covelo, and at Scotia

Then: $a = \frac{b}{c}$ times d

Recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 48 (CONTINUED)

RUNOFF OF NORTH FORK EEL RIVER NEAR MINA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F62100
LOCATION LAT 39-56-15N, LONG 123-20-45W
SW1/4 SEC. 8, T24N, R13W. MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 250 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	1000	2600	10100	105300	67700	47200	33500	19000	7900	1500	700	500	297000
1912	300	1400	3100	77500	38200	60400	24500	48000	8800	2600	1100	3100	269000
1913	2100	67000	58600	139400	33600	29200	46600	10700	4600	1900	700	600	395000
1914	500	8900	83800	318100	89300	32700	46800	33500	4700	1500	1100	1100	622000
1915	2400	44300	112800	141600	129300	93800	63000	10100	3400	1800	1100	1400	605000
1916	2500	38600	81800	114500	116100	79300	65100	25300	7700	1800	1100	1200	535000
1917	500	4000	31500	41700	103400	50800	55600	14800	4900	1600	700	500	310000
1918	400	2100	14300	10600	56800	48400	25500	4600	1500	400	200	400	16520
1919	300	4400	13600	104300	126500	91700	30800	10300	2500	900	500	200	38600
1920	400	600	17200	4000	1800	28000	38200	6400	1900	1000	300	200	10000
1921	2500	119000	158000	113600	93500	52100	16200	8300	2100	700	600	400	56700
1922	600	3300	32000	19800	91600	59500	42200	18000	4500	600	500	400	27300
1923	100	3100	53300	56500	24300	9500	36800	6500	2200	900	400	400	19400
1924	700	100	6600	12900	33400	4500	2900	800	100	0	0	0	6200
1925	10000	49400	65000	39500	217400	33000	81800	22500	7000	1600	700	1100	52900
1926	600	3800	21200	28900	146600	21300	8900	6700	1300	400	200	100	24000
1927	1800	78500	77000	84700	195500	61300	44600	10500	3900	1400	500	300	56000
1928	100	28800	27000	61900	48700	84500	64000	11900	2900	900	200	100	33100
1929	400	8100	26000	20300	35200	15300	19800	8500	4100	900	300	100	13900
1930	200	100	68000	62400	54700	39200	14400	8800	2600	800	400	400	25200
1931	400	2100	3100	50700	14200	35400	6800	2200	1400	400	200	100	11700
1932	2500	13300	77400	68100	30300	25900	22100	17700	3800	1200	500	200	26300
1933	300	800	17600	50200	40600	97600	23500	27800	9400	2100	700	400	27100
1934	100	1300	41000	51000	27900	32500	14200	7700	2500	1000	500	300	18000
1935	1400	42700	33100	104300	29500	63500	76700	14500	3600	1000	400	300	37100
1936	900	1500	18700	206800	116900	30500	25200	7300	6800	1500	600	300	41700
1937	300	200	1300	8000	87300	76900	63800	14000	7400	1800	600	400	26200
1938	1600	113400	125700	68600	209500	186300	40600	19000	6000	1500	600	200	77300
1939	800	5900	51300	29800	48100	47700	7300	5300	2400	800	400	200	20000
1940	300	200	45200	130300	181700	106200	44100	9500	3200	1300	600	400	52300
1941	1300	6700	128100	169300	101600	76200	66400	22300	8100	2700	1400	900	58500
1942	700	5300	166500	99600	147600	19000	40900	32900	14900	3500	1500	600	53300
1943	700	24700	85000	158700	47600	40900	30600	11800	8600	1900	1000	500	41200
1944	3300	4500	6200	36400	37600	42700	14900	9600	5000	1700	800	300	16300
1945	400	39900	65000	34900	105300	58500	23300	16700	6300	1700	700	300	35300
1946	800	62000	202200	76000	37600	37300	15700	6200	2400	1100	500	200	44200
1947	500	14800	20100	6500	43500	68300	25300	4500	4400	1100	700	300	19000
1948	12300	10200	8000	94500	29100	52000	87900	32800	13900	3400	1500	1400	34700
1949	2000	7600	48000	26200	67800	124800	17500	7500	2600	1100	700	200	30600
1950	500	2300	5200	101500	66500	74900	31600	13300	3800	1300	700	400	30200
1951	48700	29600	111900	164200	107700	36400	8600	8900	1900	1000	500	600	52000
1952	2300	28900	174500	144400	128700	59700	20000	14000	4100	2300	700	400	58000
1953	400	2400	119500	217200	22000	67900	27800	34500	17200	3500	1500	1100	51500
1954	900	33000	33100	198700	97600	70900	68200	5200	2900	700	300	300	51180
1955	500	17800	60600	45000	22300	25200	31400	19800	2400	700	200	100	22600
1956	300	21700	275200	228300	141200	56800	18000	12800	2700	900	400	100	75840
1957	5900	4500	4300	32800	81900	102600	29700	49500	5500	1000	300	1500	31950
1958	24500	48200	95800	145400	296300	96800	108500	12600	6200	1700	400	200	83660
1959	200	3400	9600	116900	107300	29900	13000	3400	1100	200	100	400	28550
1960	300	300	1800	20700	146800	82900	18800	24200	6100	800	200	100	30300
TOTAL	142500	1017300	2995900	4442500	4325600	2867900	1783600	752700	245200	68100	30500	25200	186970
MEAN	2900	20300	59900	88700	86500	57400	35700	15100	4900	1400	600	500	3739
PERCENT	0.8	5.4	16.0	23.8	23.1	15.4	9.5	4.0	1.3	0.4	0.2	0.1	100

TABLE 49

RUNOFF OF EEL RIVER AT ALDERPOINT

Location: Lat. 40° 10' 35", Long. 123° 36' 20", in NW 1/4 Sec. 27, T3S, R5E, HB&M, on left bank at Alderpoint, 600 feet downstream from Carter Creek.
Drainage area: 2,079 square miles.
Records available: September 1955 to date.
Recorded extremes: Maximum discharge, 376,000 cfs (December 22, 1955); minimum discharge, 12 cfs (August 17, 1959).
Remarks: Flow slightly regulated by Lake Pillsbury and by diversion to Potter Valley Powerhouse.

The recorded flows at this station were adjusted to obtain full natural flows by applying the correction factors derived for the gage at Van Arsdale Dam. Adjusted recorded flows, estimates of seasonal flows for 1907-08 through 1954-55, and estimates of monthly flows for 1920-21 through 1946-47 were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. Recorded flows for 1958-59 through 1960-61 were adjusted and estimates of monthly flows for 1910-11 through 1919-20 and 1947-48 through 1954-55 were derived by the same methods used in the previous report. These methods are described below.

Estimates of seasonal flows were calculated from a straight-line least square correlation as follows:

Let: X = incremental natural flow between gages at Van Arsdale Dam and at Scotia

Y = incremental natural flow between gages below Dos Rios, near Mina, and at Alderpoint

Z = sum of natural flows at gages below Dos Rios and near Mina

Then: $Y = 3{,}300 + 0.0892\ X$, and the full natural flows at Alderpoint equal Y plus Z

The monthly distribution of the estimated seasonal flows was determined in the following manner:

Let: a = estimated monthly full natural flow at Alderpoint

b = seasonal accretion between the gages below Dos Rios, near Mina, and at Alderpoint

c = seasonal natural runoff between the gages at Van Arsdale Dam, near Covelo, and at Scotia

d = the sum of monthly full natural flows at Van Arsdale Dam, near Covelo, and at Scotia

e = the sum of monthly full natural flows at the gages below Dos Rios and near Mina

Then: $a = \frac{(b \times d)}{c} + e$

Adjusted recorded and estimated monthly and seasonal full natural flows for this station are tabulated on the following page.

TABLE 49 (CONTINUED)

RUNOFF OF EEL RIVER AT ALDERPOINT

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F61200
LOCATION LAT 40-10-35N, LONG 123-36-20W
NW1/4 SEC. 27, T3S, R5E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 2079 SQ. MILES

EAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
911	6900	22900	68800	624800	439800	481400	363800	181300	83400	14400	5400	4800	2297700
912	3300	9500	17000	455900	248400	371800	225200	415600	82400	15900	4900	19500	1869400
913	12500	443700	386000	914600	249600	224300	367700	164400	54100	14100	5500	3200	2839700
914	4300	63000	625200	2276500	744200	429500	517700	255000	61900	16300	7200	7000	5007800
915	19000	226900	591200	910200	1157700	754000	572000	329900	104000	22600	9900	8600	4706000
916	14900	202200	628100	867700	1011500	686200	448600	193300	63700	17700	7700	7300	4148900
917	3300	28000	183400	249100	714800	361500	518500	199200	58900	12600	5400	3700	2338400
918	3200	13000	81800	73000	309300	361800	203100	49500	13600	4200	2300	4000	1118800
919	5700	39800	82500	641500	945100	694000	308300	123100	28800	8200	3400	4300	2884700
920	3500	5100	85600	21400	11200	149800	332900	56000	13500	5500	1500	1600	687600
921	17700	866000	1109800	874800	714200	447200	189900	138900	43100	9600	4400	3600	4419200
922	3100	23600	177100	114600	616100	392500	366400	187000	51700	11500	4800	3600	1952000
923	14500	46200	363100	330800	172700	75700	313900	60300	26000	8500	3300	3300	1418300
924	9200	12600	36000	72000	201700	28300	22900	13700	4600	1600	1300	800	404700
925	63300	299800	452800	258800	1517800	269800	684400	317400	87700	17200	6700	7800	3983500
926	9700	29700	108200	174100	910300	144600	223200	62100	14400	4900	2000	2100	1685300
927	12700	548200	545400	690200	1539300	479100	491200	132900	42300	12900	4400	3900	4502500
928	5900	185800	164700	395600	367400	726600	521800	103600	25800	8900	3700	2300	2512100
929	3500	58900	158200	110000	222400	104700	139600	70000	35000	9000	3000	1900	916200
930	1700	2800	477100	406900	367700	330800	157500	82600	22400	7300	2700	2800	1862300
931	2800	16600	17800	290500	98800	238200	59500	21400	12700	4300	1800	1400	765800
932	14700	76000	577700	429900	204000	203600	171200	164000	33500	8900	3200	2300	1889000
933	1800	11100	101200	260700	245800	668900	223900	251200	83200	19100	5800	4300	1877000
934	8100	12000	313300	292300	205200	208400	109800	59500	17100	6600	3100	2000	1237400
935	10400	274900	189100	628700	242500	476300	740400	145700	31400	9700	4000	3100	2756200
936	8500	11600	109800	1365000	967600	276600	269000	80800	70700	17400	5700	3500	3186200
937	2000	3700	11100	40200	501700	557000	506100	149100	60400	15800	5200	3500	1855800
938	13800	808400	1027600	480200	1523500	1529900	506800	235800	70600	15900	5900	4700	6223100
939	17300	53100	288300	177600	270900	339400	82600	56500	19900	6900	2800	2200	1317500
940	2700	5200	281300	938700	1468900	887800	397800	103100	30400	9400	4700	4400	4134400
941	8300	40500	943500	1176200	818800	677300	714000	240000	77400	23400	9100	7000	4735500
942	9200	39800	1182900	790200	1136000	165500	414300	293900	124700	25600	9400	5600	4197100
943	4700	182500	579300	1160100	372100	361000	269100	126300	65100	15800	6100	4300	3146400
944	13600	23000	34800	192600	220400	338200	136400	99200	39500	12200	4700	2500	1117100
945	5400	291700	431300	215700	725700	412400	255900	142700	50600	14100	5200	3200	2553900
946	28000	432500	1480200	565200	263200	272400	171500	68100	21300	7800	3700	3100	3317000
1947	2500	116600	135200	34600	279600	476300	181700	36300	37200	10000	4800	2600	1317400
1948	90800	61100	47600	566500	170800	354100	822600	308500	110500	23300	9200	9100	2574100
1949	14100	52100	250700	147100	418400	906100	251700	103500	26300	9700	4100	2600	2186400
1950	3100	19900	30500	603200	496200	522700	320100	133400	36900	11600	4200	3200	2185000
1951	317900	315300	920000	1099200	782300	303600	105500	130800	27800	10400	4200	5100	4022100
1952	10000	189600	1206400	933800	1059800	533800	366700	218300	64300	19000	5500	2800	4610000
1953	2500	17500	849300	1763000	193800	451200	308700	262400	148400	32900	10400	5900	4046000
1954	8500	183700	203200	1280600	691900	527200	551500	90100	35800	10900	4500	4500	3592400
1955	5700	135600	372800	310900	149300	172800	255000	200400	30800	9400	2900	2100	1647700
1956	2300	99900	2083400	1798800	1152900	471300	245000	218300	52300	12100	3800	2900	6143000
1957	35600	30800	29000	236900	648300	746600	252900	359400	55800	12400	4700	11400	2423800
1958	232800	275800	606900	960900	2421700	828400	952700	221200	64000	16100	6000	3300	6589800
1959	3000	16300	43800	758700	732100	239600	155600	52600	12700	3900	1200	5000	2024500
1960	3700	3000	12300	161000	1290800	740200	184600	165400	53700	9000	2600	1700	2628000
TOTAL	1101700	6927500	20702300	30121500	32214200	22400400	16951200	7873700	2482300	626500	238000	215400	141854700
MEAN	22000	138600	414000	602400	644400	448000	339000	157500	49600	12500	4800	4300	2837100
PERCENT	0.8	4.9	14.6	21.2	22.7	15.8	11.9	5.6	1.7	0.4	0.2	0.2	100.0

TABLE 50

RUNOFF OF SOUTH FORK EEL RIVER NEAR BRANSCOMB

Location: Lat. 39° 43' 09", Long. 123° 39' 06", in NW 1/4, Sec. 32, T22N, R16W, MDB&M, on right bank 0.4 mile upstream from Jack of Hearts Creek and 4.7 miles north of Branscomb.
Drainage area: 43.9 square miles.
Records available: October 1946 to date.
Recorded extremes: Maximum discharge, 20,100 cfs (December 22, 1955); minimum discharge 1.3 cfs (September 10, 1959).
Remarks: No regulation or diversion of above station.

The recorded flows at this station were taken as full natural flows. Estimates of seasonal flows for 1907-08 through 1945-46 and monthly flows for 1920-21 through 1945-46 were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. Estimated monthly flows for 1910-11 through 1919-20 were computed using the same methods as were used in the previous report. These methods are described below.

Estimates of seasonal flows were calculated from a straight-line least squares correlation.

Let: X = incremental natural flows between the gages at Van Arsdale Dam and at Scotia

Y = full natural flows at the gage near Branscomb

Then: $Y = 12{,}500 + 0.0213\ X$

The monthly distribution of these estimated seasonal flows were determined in the following manner:

Let: a = monthly natural flow at the gage near Branscomb

b = seasonal full natural flow at the gage near Branscomb

TABLE 50 (Continued)

c = seasonal natural runoff between the gages at Van Arsdale Dam, near Covelo, and at Scotia

d = monthly natural runoff between the gages at Van Arsdale Dam, near Covelo, and at Scotia

Then: $a = \frac{b}{c}$ times d

Recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 50 (CONTINUED)

RUNOFF OF SOUTH FORK EEL RIVER NEAR BRANSCOMB

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F64300
LOCATION LAT 39-43-09N, LONG 123-39-06W
NW1/4 SEC. 32, T22N, R16W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 44 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTA
1911	300	800	3100	32700	21000	14600	10400	5900	2400	500	200	100	9200
1912	100	400	1000	24200	11900	18900	7600	15000	2700	800	400	1000	8400
1913	600	20000	17500	41700	10000	8700	13900	3200	1400	600	200	200	11800
1914	100	2600	24000	91100	25600	9300	13400	9600	1300	400	300	300	17800
1915	700	12700	32200	40500	37000	26800	18000	2900	1000	500	300	400	17300
1916	700	11200	23700	33200	33700	23000	18900	7300	2200	500	300	300	15500
1917	100	1200	9700	12900	32100	15800	17200	4600	1500	500	200	200	9600
1918	100	700	4700	3500	18600	15800	8300	1500	500	100	100	100	5400
1919	100	1300	4100	31300	38000	27500	9300	3100	800	300	100	100	11600
1920	100	200	5900	1400	600	9500	12900	2200	700	300	100	100	3400
1921	700	33000	46400	32600	26600	15000	4600	2400	1100	300	200	100	16300
1922	200	1000	10100	6200	28800	18800	13300	5700	1400	200	200	100	8600
1923	200	1000	17300	18400	7900	3000	11900	2100	700	300	100	100	6300
1924	200	100	2300	4600	11800	1600	1000	300	100	0	0	0	2200
1925	2900	14400	18900	11500	63300	9600	23800	6600	2000	500	200	300	15400
1926	300	1200	6700	9100	46400	6800	2800	2100	400	100	100	0	7600
1927	500	22700	22300	24500	56600	17700	12900	3000	1100	400	200	100	16200
1928	0	8800	8200	18900	14900	25800	19500	3600	900	300	100	0	10100
1929	100	2700	8600	6700	11700	5100	6500	2800	1400	300	100	0	4600
1930	100	0	21600	19800	17400	12500	4500	2800	800	300	100	100	8000
1931	200	700	1000	17300	4900	12100	2300	800	500	100	100	0	4000
1932	800	4200	24400	21400	9500	8200	7000	5600	1200	400	200	100	8300
1933	100	300	5500	15800	12700	30600	7400	8700	2900	600	200	200	8500
1934	0	400	13500	16700	9200	10600	4700	2500	800	300	200	100	5900
1935	400	12800	9900	31200	8900	19000	22900	4300	1100	300	100	100	11100
1936	300	400	5600	61500	34700	9100	7500	2200	2000	400	200	100	12400
1937	100	100	400	2500	27300	24000	20000	4400	2300	600	200	100	8200
1938	400	32000	35400	19400	59100	52500	11500	5300	1700	400	200	100	2180
1939	300	1900	16400	9500	15400	15300	2300	1700	700	300	100	100	640
1940	100	100	13100	37900	52700	30900	12800	2800	900	400	200	100	1520
1941	400	1900	36800	48600	29200	21800	19100	6400	2300	800	400	300	1680
1942	200	1500	48400	29000	42900	5500	11900	9600	4400	1000	400	200	1550
1943	200	7400	25400	47400	14200	12200	9100	3500	2600	600	300	100	1230
1944	1100	1500	2000	12100	12500	14100	4900	3200	1700	600	200	100	540
1945	100	12100	19700	10600	31900	17700	7100	5100	1900	500	200	100	1070
1946	200	18200	59500	22400	11000	11000	4600	1800	700	300	200	100	1300
1947	200	4300	5000	2400	10800	21200	6100	1400	1600	500	200	100	538
1948	5400	3800	2800	28200	12200	15400	25300	7600	3500	1200	500	500	1064
1949	900	4400	21100	9200	26100	32700	3700	1700	700	400	200	100	1012
1950	200	1000	1900	37700	17600	25200	8000	2600	1100	400	200	100	960
1951	12000	13600	29500	51000	31200	14600	2400	3500	900	500	200	100	1595
1952	1000	10800	50700	42600	34800	16300	3700	2900	1400	700	300	200	1654
1953	100	900	35600	72000	4600	22200	7700	8300	4400	1300	700	400	1582
1954	700	15700	16000	57500	18400	16300	19900	2300	1300	600	400	300	1494
1955	600	6400	14700	15700	4200	4800	11500	5100	1200	600	300	200	653
1956	300	6800	81000	58500	35100	11500	2300	2200	900	400	200	200	1994
1957	3200	2500	1400	12800	22700	32900	9300	16600	3000	1100	500	500	1065
1958	7100	16800	33900	37200	72100	21200	26700	2000	1200	600	200	200	2192
1959	200	1600	2800	34500	27300	7400	5100	1400	700	300	100	300	817
1960	300	200	600	7400	51400	29800	8200	8100	3100	700	300	200	1103
TOTAL	45200	320300	902300	1334800	1258500	851900	525700	220300	77100	24100	11200	8900	55803
MEAN	900	6400	18000	26800	25200	17000	10500	4400	1500	500	200	200	1116
PERCENT	0.8	5.7	16.1	24.2	22.6	15.2	9.4	3.9	1.3	0.4	0.2	0.2	100

TABLE 51

RUNOFF OF SOUTH FORK EEL RIVER NEAR MIRANDA

Location: Lat. 40° 10' 55", Long. 123° 46' 30", in NW 1/4 Sec. 30, T3S, R4E, HB&M, on right bank at Sylvandale Campgrounds, 0.5 mile upstream from Rocky Glenn Creek, and 4.3 miles southeast of Miranda.
Drainage area: 537 square miles.
Records available: October 1939 to date.
Recorded extremes: Maximum discharge, 173,000 cfs (December 22, 1955); minimum discharge, 9 cfs (October 17, 1944).
Remarks: No diversion above station. Occasional storage and release for recreation use during the summer months at Benbow Dam.

The recorded flows at this station were taken as full natural flows. Estimates of seasonal flows for 1907-08 through 1939-40 and monthly flows for 1920-21 through 1939-40 were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959. Estimates of monthly flows for 1907-08 through 1919-20 were computed using the same methods as were used in the previous report. These methods are described below.

Estimates of seasonal flows were calculated from a straight-line least squares correlation.

Let: X = incremental natural flow between the gages at Van Arsdale Dam and at Scotia

Y = incremental natural flow between the gages near Branscomb and near Miranda

Z = full natural flow at the gage near Branscomb

Then: $Y = 72{,}100 + 0.2117\ X$

The estimated seasonal full natural flow at the gage near Miranda equals Y plus Z.

The monthly distribution of flows were determined from the estimated seasonal flows in the following manner:

Let: a = monthly natural flow at the gage near Miranda

b = seasonal full natural flow at the gage near Miranda

c = seasonal natural runoff between the gages at Van Arsdale Dam, near Covelo, and at Scotia

d = monthly natural runoff between the gages at Van Arsdale Dam, near Covelo, and at Scotia

Then: $a = \frac{b}{c}$ times d

Recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 51 (CONTINUED)

RUNOFF OF SOUTH FORK EEL RIVER NEAR MIRANDA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F64100
LOCATION LAT 40-10-55N, LONG 123-46-30W
NW1/4 SEC. 30, T3S, R4E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 537 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	3200	8500	32200	337400	217200	151300	107400	60800	25300	4800	2400	1500	952000
1912	1100	4500	10200	251800	124200	196100	79500	156000	28500	8400	3700	10000	874000
1913	6700	209900	183700	436900	105300	91400	146100	33500	14400	6000	2300	1800	1238000
1914	1600	27200	255900	971000	272400	99700	142700	102200	14200	4600	3300	3200	1898000
1915	7300	135200	344700	432400	394800	286600	192400	31000	10500	5500	3500	4100	1848000
1916	7700	118700	251500	352000	356700	244000	200200	77800	23700	5600	3500	3600	1645000
1917	1400	12700	100600	133500	330500	162600	177500	47400	15800	5100	2300	1600	991000
1918	1400	6900	47900	35600	190900	162300	85400	15500	5100	1400	800	800	554000
1919	900	13900	42800	328400	398500	288800	97200	32600	7900	2800	1500	700	1216000
1920	1500	2000	61000	14200	6400	98800	135000	22600	6900	3600	1100	900	354000
1921	7800	365200	484200	348100	286500	159600	49600	25400	6500	2100	1700	1300	1738000
1922	1800	10700	104000	64200	297300	193200	136900	58400	14600	2100	1600	1200	886000
1923	200	10300	178100	188800	81100	31600	123000	21800	7500	3000	1400	1200	648000
1924	2400	400	23600	46200	119400	16100	10400	2700	400	100	100	200	222000
1925	30900	152600	200700	121900	671700	102100	252500	69600	21500	4800	2300	3400	1634000
1926	1900	12400	68900	93900	477200	69400	28800	22000	4100	1300	800	300	781000
1927	5300	241400	236900	260500	601100	188600	137100	32300	12100	4300	1600	800	1722000
1928	200	91500	85800	196600	154500	268000	203100	37800	9300	3000	800	400	1051000
1929	1200	27400	88000	68700	119500	51900	67000	28700	13800	3200	1200	400	471000
1930	700	500	221500	202900	178000	127600	46700	28500	8300	2700	1400	1200	820000
1931	1500	7100	10600	175600	49200	122400	23600	7600	5000	1300	600	500	405000
1932	8300	43500	252300	221800	98700	84500	72200	57700	12500	4000	1800	700	858000
1933	800	2600	56900	162200	131100	315200	75900	89900	30300	6600	2300	1200	875000
1934	400	4400	137800	171000	93700	109000	47700	25800	8300	3500	1600	800	604000
1935	4400	134200	104000	327900	92800	199600	240900	45400	11200	3300	1300	1000	1166000
1936	2800	4600	58600	646400	365500	95300	78800	23000	21400	4700	2000	900	1304000
1937	1000	700	4300	26000	284200	249900	207500	45500	24000	5800	1900	1200	852000
1938	4700	343100	380100	207600	633800	563400	122800	57300	18200	4400	1800	800	2338000
1939	2800	19500	168900	98100	158400	157200	24000	17600	7800	2800	1300	600	659000
1940	900	500	139200	401700	560300	327300	135800	29400	12500	5400	2900	2500	1618400
1941	5900	19700	354600	493100	278100	211900	189500	59600	22800	9800	5600	3900	1654500
1942	4300	20000	512200	293300	455000	52100	139800	109000	51900	12900	6000	3700	1660200
1943	3800	95400	296500	474300	135200	126800	95500	44100	36800	9700	4200	2500	1324800
1944	15100	14800	16600	139900	131800	124600	39000	24600	16000	6300	3300	2200	534200
1945	4000	149300	195500	101000	307100	168100	70500	57400	20000	8300	4000	2400	1087600
1946	16400	176400	633500	232000	132200	119200	50500	16400	8600	4500	2400	1900	1394000
1947	2900	47200	51100	22000	106700	225800	63300	17200	14100	5900	3300	2200	561700
1948	40400	28200	23100	323000	100800	160900	270500	79700	32900	13000	6500	5400	1084400
1949	7000	33100	169300	95800	241800	413200	47500	22100	9400	5100	3000	1700	1049000
1950	3000	8300	17400	332100	197900	234400	98300	31100	12000	5500	2900	2000	944900
1951	177400	138000	372300	494100	360700	135400	26300	29600	9700	5200	2900	2400	1754000
1952	8600	104800	512000	437400	399300	172700	47000	29300	13900	8100	3700	2700	1739500
1953	2900	8800	403600	750100	62100	219600	82800	85000	45300	15700	7600	4900	1688400
1954	8500	126300	122800	662600	236300	203000	210600	26800	13300	7500	4600	4700	1627000
1955	6200	64800	170200	167200	50200	45400	138100	51700	14300	6200	3400	2900	720600
1956	4000	62600	810300	638900	413100	138700	30000	22400	10400	5200	3200	2500	2141300
1957	27400	16800	14000	114800	230900	315500	81400	140600	29600	9200	5000	7500	992700
1958	85800	150500	303500	402900	865200	245600	337300	27200	12200	6800	3600	2900	2443500
1959	2500	12100	30600	410100	337600	85300	53800	18200	7400	4100	2300	6200	970200
1960	3500	3000	7600	79400	505000	296900	81900	107200	38100	10900	5000	3100	1141600
TOTAL	542400	3292200	9351600	13987300	13397900	8908600	5601300	2305000	820300	276100	137300	116500	58736500
MEAN	10800	65800	187000	279900	268000	178200	112000	46100	16400	5500	2700	2300	1174700
PERCENT	0.9	5.6	15.9	23.9	22.8	15.2	9.5	3.9	1.4	0.5	0.2	0.2	100.0

TABLE 52

RUNOFF OF EEL RIVER AT SCOTIA

Location: Lat. 40° 29' 30", Long. 124° 05' 55", in SW 1/4 Sec. 5, T1N, R1E, HB&M, near center of span in left pier of bridge on U. S. Highway 101, 0.5 mile north of Scotia.
Drainage area: 3,113 square miles.
Records available: October 1910 to January 1915, October 1916 to date.
Recorded extremes: Maximum discharge, 541,000 cfs (December 22, 1955); minimum discharge, 10 cfs (August 12-14, 1924).
Remarks: Flow slightly regulated by Lake Pillsbury and by diversion to Potter Valley Powerhouse.

The recorded flows at this station were adjusted to obtain full natural flows by applying the correction factors derived for the gage at Van Arsdale Dam.

Adjusted recorded flows through 1957-58 and estimated monthly and seasonal natural flows for 1914-15 and 1915-16 were taken from the Hydrology Unit office report, "Estimates of Full Natural Flows in the Eel River Basin," dated November 1959.

Recorded flows for 1958-59 through 1960-61 were adjusted in the same manner as was used in the previous report.

Adjusted recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 52 (CONTINUED)

RUNOFF OF EEL RIVER AT SCOTIA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F61100
LOCATION LAT 40-29-30N, LONG 124-05-55W
SW1/4 SEC. 5, T1N, R1E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 3113 SQ. MILES

AR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
11	13200	40000	133400	1302000	875600	785000	579500	303200	134100	24000	10300	7700	4208000
12	5900	19500	38400	959900	516900	747900	365500	728900	142400	36300	14800	44100	3620500
13	29100	858400	757100	1746000	482000	420700	699300	227600	80200	27400	11400	7400	5346600
14	7400	115900	1123000	4165000	1274000	623400	795300	453800	89500	25300	13700	13200	8699500
15	33200	489700	1261600	1751300	1925600	1311400	946200	390100	124500	33200	16600	16600	8300000
16	29500	434900	1120400	1555300	1710100	1164600	840300	346400	110600	29500	14700	14700	7371000
17	6500	53200	384000	515500	1375000	686500	872900	293700	90400	22900	10200	6600	4317400
18	6000	27200	181600	147400	707400	700000	381100	81500	24300	7100	4100	5600	2273300
19	7400	67900	167600	1292900	1735000	1266900	500800	187700	44100	14100	6700	5400	5296500
20	6700	9000	211600	50700	24600	353800	611600	102600	27700	13100	3800	3400	1418600
21	32900	1579800	2056000	1555000	1274000	759100	286600	188400	55900	13700	7800	6300	7815500
22	6800	45000	385600	243200	1212300	780000	641000	304100	81100	15800	8200	6000	3729100
23	14900	67300	730400	720400	340000	140700	567700	105300	41500	14600	6400	5800	2755000
24	14200	13400	85200	168400	450700	61900	44700	19400	5400	1900	1600	1200	868000
25	123700	598000	844900	496900	2830200	469300	1177900	453500	129700	26700	11200	14400	7176400
26	13500	55000	248400	365300	1882400	285900	281900	106900	22800	7500	3500	2700	3275800
27	23000	1019300	1007700	1198500	2712200	847200	758500	195800	66000	21300	7600	5400	7862500
28	6300	368800	336300	788800	676400	1262200	927700	179300	44500	15000	5300	3100	4613700
29	6000	116700	343300	254500	473800	213900	280500	130700	64000	15700	5600	2800	1907500
30	3000	3800	925500	817500	728000	589100	252100	140200	39200	12700	5600	5200	3521900
31	6100	31300	39800	657900	201600	494100	108800	37200	23200	7100	2900	2400	1612400
32	31500	163600	1085900	876700	402900	373900	316700	280300	58800	17100	6800	3600	3617800
33	3400	16300	215900	587400	510100	1303800	376800	432400	144200	32300	10500	6800	3639900
34	9000	21100	597700	645000	398500	433300	208400	112600	34300	13800	6400	3700	2483800
35	19200	541700	395900	1280900	426900	873100	1219500	235900	53700	16400	6600	5100	5074900
36	14100	20800	225400	2639100	1688100	464500	424500	126100	113000	26800	9500	5200	5757100
37	4200	5100	19900	92600	1073900	1060600	924000	240900	108500	27200	9000	5800	3571700
38	22900	1471700	1762600	881700	2749400	2619600	744300	346600	105800	24400	9300	6100	10744400
39	23000	93400	637000	380000	597900	664100	132300	92900	35900	12600	5600	3400	2678100
40	4500	6200	554100	1725500	2565900	1528700	663700	160600	49500	17200	8100	7200	7291200
41	16400	80700	1709800	2189300	1426300	1133000	1110900	373500	126000	39300	17400	12000	8234600
42	13300	71500	2187200	1390900	2026400	280100	660800	492100	214700	46800	18300	9600	7411700
43	9100	335200	1104500	2139800	666400	613400	457900	199600	117900	27900	12100	7600	5691400
44	36900	54800	77800	447100	482800	635900	240700	166000	74700	24400	10200	4500	2255800
45	8100	542300	839400	435000	1385100	779900	401800	247600	90100	24900	9500	5500	4769200
46	32700	812400	2720700	1031700	493900	501500	268000	105800	36300	14300	7000	4500	6028800
47	6100	218300	273000	79500	578900	945500	355600	67600	67400	17300	9800	4600	2623600
48	168100	125700	97800	1161400	354000	681700	1376500	515600	198500	44500	18900	17900	4760600
49	27100	101200	559000	315400	853700	1704900	363800	151900	42800	17000	8300	4100	4149200
50	6200	34600	63900	1254000	922700	1003400	522700	218700	61500	20000	8400	5400	4121500
51	611700	494100	1594300	2089700	1431500	522800	157100	184800	39500	16100	7300	8600	7157500
52	27600	383500	2244900	1757200	1807900	859000	485400	317400	88500	36400	11200	6400	8025400
53	6000	31400	1492100	3052800	347500	864300	489200	514600	275100	55800	21800	14000	7164600
54	21900	409600	479400	2613100	1286800	943600	934800	141100	62500	25800	12600	14800	6946000
55	16900	277200	702400	703100	268800	275800	524000	340300	59300	22000	9200	7500	3206500
56	10400	234200	3718400	2983800	1845000	749900	285100	251000	87000	24400	9200	6600	10205000
57	73600	73100	65900	468900	1073600	1371200	407900	618200	124700	33700	15600	23400	4349800
58	398600	535300	1186100	1769100	4328700	1312300	1653100	315500	112300	32200	13100	9100	11665400
59	9100	44200	103100	1651000	1473600	448300	276300	75900	27900	11300	4500	13300	4138500
60	10600	9600	25400	315500	2100800	1283200	361300	393700	133600	32100	13100	7500	4686400
OTAL	2037500	13222900	39121300	57709600	58975800	40194900	28263000	12695500	4185100	1138900	481300	413800	258439600
EAN	40800	264500	782400	1154200	1179400	803900	565300	253900	83700	22800	9600	8300	5168800
ERCENT	0.8	5.1	15.1	22.3	22.9	15.6	10.9	4.9	1.6	0.4	0.2	0.2	100.0

TABLE 53

RUNOFF OF VAN DUZEN RIVER NEAR DINSMORES

Location: Lat. 40° 29' 15", Long. 123° 37' 50", in SE 1/4 Sec. 5, T1N, R5E, HB&M on right bank 2.0 miles upstream from South Fork and 1.4 miles west of Dinsmores.
Drainage area: 80 square miles.
Records available: August 1953 to September 1958 (discontinued).
Recorded extremes: Maximum discharge 21,400 cfs (December 22, 1955); minimum discharge 1.8 cfs (August 29, 1958).
Remarks: No regulation or diversion above station.

Recorded flows at this station were taken as full natural flows.

Estimates of seasonal natural flows for 1907-08 through 1951-52 and 1958-59 through 1959-60 were obtained by a least squares correlation utilizing data processing Program No. 3020.80.1. Data from this correlation are:

$Y = 48,800 + 0.0328\ X$

Y = seasonal full natural flow, Van Duzen River near Dinsmores.

X = seasonal full natural flow, Eel River at Scotia

$\bar{r}$ = correlation coefficient = 0.9901

$\bar{S}y$ = standard error of estimate = 15,100 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Scotia was used as the base station.

Recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 53 (CONTINUED)

RUNOFF OF VAN DUZEN RIVER NEAR DINSMORES

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F65400
LOCATION LAT 40-29-15N, LONG 123-37-50W
SE1/4 SEC. 5, T1N, R5E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 80 SQ. MILES

AR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
11	700	2800	6800	54100	39300	35300	25100	15100	6400	900	200	300	187000
12	300	1500	2000	40800	23900	34600	16300	37300	7100	1600	400	1900	167700
13	1500	52700	33100	61800	18500	16200	26000	9700	3300	1000	300	300	224400
14	400	7100	49600	149300	49400	24200	29800	19500	3700	800	300	400	334500
15	1700	29000	53400	60000	71500	48800	33900	16000	4900	1100	400	600	321300
16	1500	26300	48400	54300	64600	44200	30700	14500	4500	1000	300	500	290800
17	400	3700	19100	20800	60000	30100	36800	14200	4200	900	200	200	190600
18	400	2400	11100	7300	38100	37700	19700	4800	1300	300	100	300	123500
19	400	4600	8000	50500	73300	53700	20500	8800	2000	500	200	200	222700
20	600	900	16000	3100	1600	23500	39200	7500	1900	800	100	200	95400
21	1500	86000	80000	49000	43500	26000	9400	7100	2000	500	200	200	305400
22	400	3300	19800	10100	54500	35200	27900	15200	3900	600	200	200	171300
23	1000	5200	41000	32600	16600	6900	26900	5700	2200	700	200	300	139300
24	1600	1900	8500	13700	39700	5400	3800	1900	500	100	100	100	77300
25	6200	35400	35700	17000	105000	17500	42200	18600	5200	900	300	500	284500
26	800	4100	13300	15900	88900	13500	12800	5500	1100	300	100	100	156400
27	1100	58700	41400	39800	97600	30600	26400	7800	2500	700	200	200	307000
28	400	24500	15900	30300	28200	52600	37300	8300	2000	600	100	100	200300
29	400	10400	21700	13000	26300	11900	15000	8000	3700	800	200	100	111500
30	200	300	48200	34500	33300	27100	11100	7100	1900	500	100	200	164500
31	500	3200	2900	38900	12900	31800	6800	2600	1600	400	100	100	101800
32	1900	11400	54200	35400	17700	16400	13300	13500	2700	700	200	200	167600
33	200	1200	11200	24800	23400	60100	16700	21900	7000	1300	300	300	168400
34	600	1700	35000	30600	20400	22400	10400	6400	1800	700	200	200	130400
35	1100	34900	18100	47600	17200	35300	47400	10600	2300	600	200	200	215500
36	700	1400	10900	103500	71700	19800	17400	5900	5100	1100	200	200	237900
37	200	300	1000	4000	50100	49600	41600	12400	5400	1100	200	200	166100
38	1000	79900	68100	27600	93400	89200	24400	13000	3800	800	200	200	401600
39	1500	7200	35400	17100	29100	32400	6200	5000	1900	600	200	200	136800
40	200	400	25100	63400	102400	61000	25500	7000	2100	600	200	300	288200
41	800	4900	74300	77300	54500	43400	41000	15800	5100	1300	400	400	319200
42	700	4300	94900	48800	77000	10600	24200	20700	8700	1600	400	300	292200
43	500	21500	50400	78900	26700	24600	17700	8800	5000	1000	300	300	235700
44	2700	4700	4700	22200	26000	34300	12500	9800	4300	1200	300	200	122900
45	500	34300	37800	15800	54700	30900	15400	10900	3800	900	200	200	205400
46	1600	47000	112100	34400	17800	18200	9400	4200	1400	500	100	100	246800
47	400	16900	15100	3500	28100	46000	16600	3600	3500	800	300	200	135000
48	9600	8500	4700	45500	15100	29000	56500	24300	9000	1700	500	700	205100
49	1600	7000	27500	12600	36900	74000	15200	7300	1900	700	200	200	185100
50	300	2500	3300	52400	41900	45700	22900	11000	3000	800	200	200	184200
51	30400	28900	66600	70700	52500	19200	5600	7500	1500	500	100	300	283800
52	1400	22700	94200	59900	66800	31900	17400	12900	3500	1200	200	200	312300
53	300	2000	67100	111200	13600	34200	18600	22400	11600	2100	500	500	284100
54	1000	25300	22700	108500	54000	34300	38000	4400	2400	700	200	400	291900
55	700	17800	33600	18000	12100	14000	19100	16000	2800	900	300	200	135500
56	400	19100	143500	100100	56400	30600	19300	14400	3300	1000	300	200	388600
57	6600	4200	4900	16100	50300	64900	19500	27600	5500	1300	300	1300	202500
58	15500	28400	52300	74600	151300	33000	44000	14400	4800	1000	300	200	419800
59	400	2000	4600	73700	65700	20000	12300	3400	1200	500	200	600	184600
60	500	400	1100	13600	90800	55500	15600	17000	5800	1400	600	300	202600
OTAL	105300	804800	1750300	2188600	2404300	1687300	1141300	587300	186100	43600	12100	16000	10927000
EAN	2100	16100	35000	43800	48200	33700	22800	11700	3700	900	200	300	218500
ERCENT	1.0	7.4	16.0	20.0	22.1	15.4	10.4	5.4	1.7	0.4	0.1	0.1	100.0

TABLE 54

RUNOFF OF VAN DUZEN RIVER NEAR BRIDGEVILLE

Location: Lat. 40° 27' 50", Long. 123° 51' 25", in E 1/2 Sec. 17, T1N, R3E, HB&M on downstream side of right pier of bridge on State Highway 36, 0.5 mile upstream from Rogers Creek and 4 miles west of Bridgeville.
Drainage area: 216 square miles (revised in 1961; previous area of 214 square miles was used on computations for this report).
Records available: October 1950 to date.
Recorded extremes: Maximum discharge 43,500 cfs (December 22, 1955); minimum discharge, 5.0 cfs (September 13, 1959).
Remarks: No storage or large diversion above station.

The recorded flows at this station were taken as full natural flows. This period of record was extended for correlation purposes by transferring the recorded flows of the gage "Van Duzen River at Bridgeville" for 1939-40 through 1949-50 to the gage near Bridgeville. The flows at Bridgeville were multiplied by a factor of $\frac{214}{200}$ or 1.070, the ratio of the drainage areas above the gages.

Estimates of seasonal natural flows for 1907-08 through 1938-39 were obtained by a least squares correlation utilizing data processing program No. 3020.80.1. Data from this correlation are:

$\text{Log } Y = \text{Log } 1.3551 + 0.7670 \text{ Log } X$

Y = seasonal natural flow, Van Duzen River near Bridgeville, in 100 acre-feet

X = seasonal natural flow, Eel River at Scotia, in 100 acre-feet

$\bar{r}$ = correlation coefficient = 0.9901

$\bar{S}y$ = standard error of estimate = 20,000 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Scotia was used as the base station.

TABLE 54 (Continued)

Recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 54 (CONTINUED)

RUNOFF OF VAN DUZEN RIVER NEAR BRIDGEVILLE

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F65300
LOCATION LAT 40-27-50N, LONG 123-51-25W
E 1/2 SEC. 17, T1N, R3E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 216 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	2300	7200	17300	147500	97700	84700	66600	38300	17500	2600	1000	900	483600
1912	1000	3600	5000	110300	58400	81800	42600	93300	18800	4000	1400	5000	425200
1913	4200	131200	82600	166800	45300	38300	67800	24200	8800	2500	900	700	573300
1914	1100	17200	119300	387400	116500	55200	75000	47100	9600	2200	1100	1200	832900
1915	4700	71700	132100	160400	173600	114400	88000	39800	13100	2900	1300	1400	803400
1916	4300	65500	120600	146400	158500	104400	80300	36400	11900	2600	1200	1300	733400
1917	1100	9400	48400	56900	149400	72200	97800	36100	11400	2400	1000	700	486800
1918	1200	5600	26900	19100	90400	86600	50200	11800	3600	800	400	700	297300
1919	1200	11600	20500	138600	183100	129300	54500	22400	5400	1400	600	500	569100
1920	1400	2000	34200	7200	3400	47700	87900	16200	4500	1700	500	500	207200
1921	4300	214100	199300	131900	106300	61300	24600	17800	5500	1100	600	500	767300
1922	1200	8200	50300	27700	136100	84800	74200	38600	10600	1700	800	700	434900
1923	2700	12700	98600	85100	39500	15800	68100	13800	5600	1600	600	700	344800
1924	3500	3400	15600	26900	71000	9400	7300	3500	1000	300	200	200	142300
1925	17600	88700	89600	46100	258700	41500	111000	46900	13900	2300	900	1300	718500
1926	2400	10400	33600	43200	219300	32200	33900	14100	3100	800	400	300	393700
1927	3100	146200	103400	107600	239700	72400	69100	19500	6800	1800	600	400	770600
1928	1000	62200	40500	83200	70200	126800	99300	21100	5300	1500	500	300	511900
1929	1200	23800	50100	32500	59500	26000	36300	18600	9400	1900	600	400	260300
1930	600	700	120900	93400	81900	64100	29200	17900	5100	1400	600	600	416400
1931	1300	7000	6400	92800	28000	66400	15600	5800	3700	900	300	300	228500
1932	5200	28400	135000	95400	43100	38700	34900	34000	7400	1700	600	400	424800
1933	600	3000	28500	68000	58200	143900	44300	55800	19200	3600	1000	800	42690
1934	1700	4100	84300	79700	48400	51000	26100	15500	4900	1600	700	500	318500
1935	3000	87200	45600	129000	42300	83700	124700	26500	6200	1500	500	500	55070
1936	2200	3400	27000	276500	174000	46400	45100	14700	13600	2700	800	500	60690
1937	800	900	2700	10900	124700	119200	110700	31600	14700	3000	900	700	42080
1938	2800	195600	167400	73300	224900	207400	62800	32100	10000	1900	700	500	97940
1939	4200	17900	87400	45600	70600	75900	16100	12400	4900	1400	600	400	33740
1940	500	600	86200	157600	215400	139100	46300	17400	3900	1100	600	700	66940
1941	4200	16100	196100	209500	127800	80600	82700	34700	11000	3600	1200	1000	76850
1942	1100	12300	229800	138600	158700	26600	65800	69200	20100	3800	1100	600	72770
1943	700	55200	139600	169900	65400	67800	60000	22000	22200	3000	1200	600	60760
1944	7200	11000	13700	55000	59900	61200	37200	20800	14300	3400	1100	600	28540
1945	1800	80000	88600	58600	158400	71200	45100	42600	9200	2200	700	500	55890
1946	9800	122800	240200	87500	64700	69700	24700	8200	3000	1200	600	500	63290
1947	900	41700	33000	13800	74700	105500	41100	6000	11700	1900	800	600	33170
1948	27000	20300	18200	153000	40300	65400	153900	58400	24400	4700	1800	2000	56940
1949	3500	16900	80400	30600	85900	170300	35700	20500	4900	1600	700	400	45140
1950	900	6300	13400	136600	106000	128400	62700	25600	6800	1800	600	400	48950
1951	88300	81000	159100	184200	120100	53800	15500	21800	3800	1400	700	500	73020
1952	5500	72500	196600	119200	168700	80400	57000	33800	7900	2800	1000	600	74600
1953	700	2500	144000	276000	46100	78500	61000	70100	35300	6000	2200	1200	72360
1954	3400	76200	70700	266600	128400	83600	84700	9400	6400	2100	1100	1100	73370
1955	2000	34400	100000	62300	31100	30200	57300	34200	5400	2100	800	700	36050
1956	1100	52900	371800	267000	149800	74300	34200	27400	7800	2400	1000	600	99030
1957	17800	11500	22100	53200	116400	138800	49300	66700	8600	2300	1200	3300	49120
1958	39000	77200	126800	173800	346100	91200	113700	22900	9200	3400	1500	1000	100580
1959	900	8600	18300	224200	144400	54000	27400	7200	3100	1300	500	1400	49130
1960	1300	1000	5000	45700	181700	115700	38800	59000	15000	2900	1000	600	46770
TOTAL	299500	2043900	4346700	5772300	5762700	3967800	2938100	1483700	489500	110800	42700	41800	2729950
MEAN	6000	40900	86900	115300	115300	79400	58800	29700	9800	2200	900	800	54600
PERCENT	1.1	7.5	15.9	21.2	21.1	14.5	10.8	5.4	1.8	0.4	0.2	0.1	100.

TABLE 55

RUNOFF OF YAGER CREEK NEAR CARLOTTA

Location: Lat. 40° 34' 10", Long. 124° 03' 10", in SE 1/4 Sec. 10, T2N, R1E, HB&M, on right bank 0.6 mile upstream from Cooper Mill Creek and 2.3 miles north of Carlotta.
Records available: August 1953 to October 1955, August 1956 to September 1960 (discontinued).
Recorded extremes: Maximum discharge, 28,000 cfs (December 22, 1955); minimum discharge 4.4 cfs (October 8, 9, 1956).
Remarks: No regulation or diversion above station.

Recorded flows at this station were taken as full natural flows.

Monthly and seasonal natural flows for 1911-12 and 1912-13 were obtained from the records of the gage that was in operation at Carlotta from September 1911 through January 1914. These recorded flows were multiplied by a factor of 0.9478, the ratio of the drainage areas above the gages, to obtain natural flows at the gage near Carlotta.

Estimates of seasonal natural flows for 1907-08 through 1910-11, 1913-14 through 1952-53 and 1955-56 were obtained by a least squares correlation utilizing data processing program No. 3020.80.1. Data from this correlation are:

$Y = 130,100 + 2.6302\ X$

Y = seasonal flow at the gage near Carlotta, in acre-feet

X = seasonal full natural flow at the gage Eel River at Scotia, in 100 acre-feet

$\bar{r}$ = correlation coefficient = 0.9848

$\bar{S}y$ = standard error of estimate = 14,200 acre-feet

TABLE 55 (Continued)

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Scotia was used as the base station.

Recorded and estimated monthly and seasonal full natural flows at this station are tabulated on the following page.

TABLE 55 (CONTINUED)

RUNOFF OF YAGER CREEK NEAR CARLOTTA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F65120
LOCATION LAT 40-34-10N, LONG 124-03-10W
SE1/4 SEC. 10, T2N, R1E, HBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 127 SQ. MILES

AR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
11	800	3500	12500	85800	48800	40500	30400	10700	5600	1300	600	300	240800
12	100	1100	5000	62900	43600	37900	28000	29600	3700	1100	300	1200	214500
13	900	35500	54200	68900	10800	15700	23600	7900	1800	1200	400	100	221000
14	400	6500	67900	176400	45600	20700	26800	10300	2400	900	600	400	358900
15	1400	28400	78600	76400	71100	44800	32900	9100	3400	1100	700	500	348400
16	1300	26400	72900	71000	66200	41700	30500	8400	3300	1100	700	500	324000
17	400	4500	35300	33200	75000	34700	44700	10100	3700	1200	600	300	243700
18	500	3500	24900	14200	57900	52900	29200	4100	1500	500	300	400	189900
19	400	5300	13900	75100	85300	57700	23100	5800	1600	600	400	200	269400
20	900	1600	40600	6800	2800	37300	65500	7300	2400	1400	500	300	167400
21	1200	81200	113600	60100	41700	23000	8800	3900	1400	400	200	200	335700
22	500	4200	38700	17100	72300	43000	35800	11400	3600	800	500	300	228200
23	1100	6400	74900	51800	20700	7900	32400	4000	1900	800	400	300	202600
24	2800	3400	23100	31900	72300	9200	6700	2000	700	300	300	200	152900
25	6000	37900	57500	23700	114100	17600	44700	11500	3900	1000	500	500	318900
26	1000	5400	26100	27000	117700	16600	16600	4200	1000	400	200	100	216300
27	1000	58900	62500	52100	99700	28800	26200	4600	1900	700	300	200	336900
28	400	29300	28700	47200	34200	59000	44100	5800	1700	700	300	100	251500
29	600	15300	48400	25100	39600	16500	22000	6900	4000	1200	500	200	180300
30	200	300	82900	51400	38800	29000	12600	4700	1600	600	400	200	222700
31	700	4900	6800	78300	20300	46000	10300	2400	1700	600	300	200	172500
32	1900	13000	92600	52400	20400	17500	15000	8900	2200	800	400	200	225300
33	200	1700	22900	43700	32100	75900	22300	17200	6800	1900	800	300	225800
34	700	2200	67200	50900	26500	26800	13100	4700	1800	800	500	200	195400
35	1100	39700	31200	70400	19900	37700	53500	6900	1900	700	300	300	263600
36	700	1500	17100	140000	75800	19300	17900	3600	3800	1100	500	200	281500
37	300	500	2200	7300	71900	65700	58000	10200	5400	1600	700	300	224100
38	800	76000	97500	34200	90400	79700	23000	7200	2600	700	400	200	412700
39	1800	9400	68500	28600	38200	39300	8000	3700	1800	700	400	200	200600
940	200	400	38800	84600	106500	58700	25800	4200	1500	600	400	200	321900
941	800	4600	104800	94100	51900	38100	37900	8500	3500	1300	800	400	346700
942	600	4100	134600	59900	73900	9500	22700	11300	6000	1500	700	300	325100
943	500	21500	76100	103200	27200	23200	17600	5100	3600	1000	500	300	279800
944	3600	7100	10800	43800	40000	48800	18800	8700	4700	1800	1000	300	189400
945	500	39300	65400	23700	64000	33300	17400	7200	3100	1000	500	200	255600
946	1300	43600	156900	41700	16800	15900	8600	2200	900	500	200	100	288700
947	500	24200	32600	6700	40900	61800	23600	3000	3600	1100	800	300	199100
948	10900	10500	8800	73300	19000	33800	69300	17500	8000	2200	1200	800	255300
949	1700	8500	50800	20100	46100	85200	18400	5200	1700	800	500	200	239200
950	400	3100	6100	83800	52300	52700	27800	7800	2700	1100	500	200	238500
951	26500	27700	96000	88300	51200	17300	5200	4100	1000	500	300	300	318400
952	1100	20800	130900	71800	62500	27500	15700	6900	2300	1100	400	200	341200
953	300	1900	95400	136600	13200	30300	17400	12300	7900	1900	900	500	318600
954	1600	42400	43600	94400	50300	34700	23000	3800	4500	1400	800	600	301100
955	700	9900	50200	58500	15700	16000	42500	11700	2300	1000	500	500	209500
956	300	11100	188700	106100	55500	20800	8000	4800	2000	700	300	200	398500
957	9200	6100	30500	46400	50200	69000	23800	24800	3700	1400	700	900	266700
958	10400	37600	61000	79400	151800	43500	47500	4300	2700	1100	500	400	440200
959	500	4700	6900	95800	85100	22300	9800	2600	1100	600	400	500	230300
960	500	400	2300	14600	75400	41000	17600	28100	5800	1600	700	400	188400
OTAL	102200	837000	2759400	2990700	2703200	1825800	1304100	411200	151700	50400	25600	16400	13177700
EAN	2000	16700	55200	60000	54100	36500	26100	8200	3000	1000	500	300	263600
ERCENT	0.8	6.3	20.9	22.9	20.5	13.8	9.9	3.1	1.1	0.4	0.2	0.1	100.0

TABLE 56

ESTIMATED MEAN MONTHLY DISTRIBUTION OF NATURAL RUNOFF
FROM EEL RIVER HYDROGRAPHIC UNIT

50-YEAR MEAN PERIOD, 1910-60

Subunits and related gaging stations		October		November		December		January		February		March		April		May		June		July		August		September		Total
Ref. No.	Name	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Acre-feet
F-6A	Lake Pillsbury	0.6	2,800	3.4	15,200	12.9	57,900	20.7	92,700	24.5	109,500	17.0	76,200	12.4	55,600	5.7	25,500	1.9	8,400	0.5	2,300	0.2	1,000	0.2	700	447,800
F-6 1450	Eel River at Van Arsdale Dam (gage)		2,800		15,200		57,900		92,700		109,500		76,200		55,600		25,500		8,400		2,300		1,000		700	447,800
F-6B	Outlet Creek	0.8	2,100	5.3	13,900	16.2	42,400	23.8	62,400	23.5	61,600	15.3	40,100	9.4	24,700	3.7	9,800	1.2	3,200	0.3	900	0.3	400	0.2	300	261,800
F-6 C	Willis Ridge	0.8	2,300	5.3	15,200	16.2	46,500	23.8	68,500	23.5	67,600	15.3	43,900	9.4	27,000	3.7	10,800	1.2	3,500	0.3	1,000	0.3	400	0.2	300	287,000
	Subtotal: All preceding sub-units		7,200		44,300		146,800		223,600		238,700		160,200		107,300		46,100		15,100		4,200		1,800		1,300	996,600
F-6 1330	Eel River above Dos Rios (gage)		7,200		44,300		146,800		223,600		238,700		160,200		107,300		46,100		15,100		4,200		1,800		1,300	996,600
F-6D	Round Valley	0.2	200	2.2	3,000	10.1	13,900	14.3	19,700	32.1	44,100	21.2	29,200	14.7	20,200	4.6	6,400	0.6	800	0.0	0	0.0	0	0.0	0	137,500
F-6E	Wilderness	0.9	3,600	4.7	19,100	12.3	49,400	15.3	61,700	19.6	78,800	16.4	65,900	17.4	69,800	9.5	38,000	2.9	11,500	0.6	2,500	0.2	700	0.2	900	401,900
F-6F	Black Butte	0.9	2,000	4.7	10,800	12.3	28,100	15.4	35,100	19.6	44,800	16.4	37,400	17.4	39,600	9.5	21,600	2.9	6,600	0.6	1,400	0.2	400	0.2	500	228,300
F-6 3100	Middle Fork Eel River below Black Butte River (gage)		5,600		29,900		77,500		96,800		123,600		103,300		109,400		59,600		18,100		3,900		1,100		1,400	630,200
F-6G	Etsel	1.1	3,100	6.8	19,100	18.8	52,900	26.6	74,900	19.0	53,700	11.5	32,500	8.6	24,200	4.8	13,400	1.9	5,600	0.5	1,600	0.2	500	0.2	500	282,000
	Subtotal: All preceding sub-units		16,100		96,300		291,100		415,000		460,100		325,200		261,100		125,500		39,600		9,700		3,400		3,200	2,046,300
F-6 1300	Eel River below Dos Rios		16,100		96,300		291,100		415,000		460,100		325,200		261,100		125,500		39,600		9,700		3,400		3,200	2,046,300
F-6H	North Fork	0.8	3,000	5.4	21,500	16.0	63,300	23.8	93,800	23.1	91,400	15.3	60,600	9.6	37,700	4.0	16,000	1.3	5,200	0.4	1,500	0.2	600	0.1	500	395,100
F-6J	Bell Springs	0.8	3,000	5.3	20,800	15.1	59,600	23.7	93,600	23.4	92,800	15.7	62,200	10.2	40,200	4.0	16,000	1.2	4,800	0.3	1,300	0.2	800	0.1	600	395,700
	Subtotal: All preceding sub-units		22,100		138,600		414,000		602,400		644,300		448,000		339,000		157,500		49,600		12,500		4,800		4,300	2,837,100
F-6 1200	Eel River at Alderpoint (gage)		22,100		138,600		414,000		602,400		644,300		448,000		339,000		157,500		49,600		12,500		4,800		4,300	2,837,100
F-6K	Sequoia	0.5	2,000	3.6	14,100	14.0	54,600	24.0	93,700	24.5	95,700	16.2	63,700	10.3	40,300	4.5	17,600	1.5	6,100	0.5	1,800	0.2	600	0.2	600	390,800
F-6L	Yager Creek	0.8	2,200	6.4	17,600	20.9	57,900	22.7	62,800	20.5	56,800	13.8	38,200	9.9	27,400	3.1	8,600	1.1	3,100	0.5	1,100	0.2	700	0.1	300	276,700
F-6 5120	Yager Creek near Carlotta (gage)		2,100		16,800		55,200		59,800		54,100		36,400		26,100		8,200		3,000		1,000		600		300	263,600
F-6M	Van Dusen River	1.1	7,800	7.5	53,400	15.9	113,400	21.1	150,600	21.1	150,300	14.5	103,600	10.8	76,700	5.4	38,800	1.8	12,800	0.4	2,900	0.2	1,200	0.2	1,100	712,600
F-6N	Larabee Creek	0.5	1,000	3.6	7,300	14.0	28,000	24.0	48,100	24.5	49,200	16.3	32,700	10.3	20,700	4.5	9,000	1.5	3,100	0.5	900	0.1	300	0.2	300	200,600
F-6P	Laytonville	0.8	2,500	5.7	17,600	16.2	49,800	23.9	73,400	22.6	69,200	15.2	46,700	9.4	28,900	4.0	12,100	1.3	4,100	0.5	1,400	0.2	500	0.2	500	306,700
F-6Q	Lake Benbow	1.0	8,400	5.6	48,300	15.8	137,200	23.8	206,300	22.9	198,800	15.0	131,500	9.6	83,100	3.9	34,000	1.4	12,300	0.5	4,100	0.3	2,200	0.2	1,800	868,000
F-6 4100	South Fork Eel River near Miranda (gage)		10,900		65,900		187,000		279,700		268,000		178,200		112,000		46,100		16,400		5,500		2,700		2,300	1,174,700
F-6R	Humboldt Redwoods	0.5	2,100	3.6	14,500	14.0	55,900	24.0	96,000	24.5	98,100	16.3	65,200	10.3	41,300	4.5	18,000	1.5	6,200	0.5	1,800	0.1	600	0.2	600	400,300
	Subtotal: South Fork Eel River Basin		13,000		80,400		242,900		375,700		366,100		243,400		153,300		64,100		22,600		7,300		3,300		2,900	1,575,000

ESTIMATED MEAN MONTHLY DISTRIBUTION OF NATURAL RUNOFF

50-YEAR MEAN PERIOD, 1910-60

Subunit and related gaging station		October		November		December		January		February		March		April		May		June		July		August		September		Total
Ref. No.	Name	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Acre-feet
F-6S	Lower Eel	0.5	1,600	3.6	11,100	14.0	42,700	24.0	73,200	24.5	75,000	16.3	49,900	10.3	31,500	4.5	13,700	1.5	4,700	0.5	1,400	0.1	400	0.2	400	305,600
	Subtotal: Eel River Basin		49,700		322,500		953,500		1,406,500		1,437,400		979,500		688,900		309,300		102,000		27,900		11,300		9,900	6,298,400
F-6T	Eureka Plain	0.8	2,200	6.4	17,200	21.0	56,300	22.7	61,000	20.5	55,200	13.8	37,200	9.9	26,600	3.1	8,400	1.1	3,000	0.4	1,000	0.2	600	0.1	300	269,000
F-7U	Cape Mendocino	1.2	17,500	8.9	134,400	16.3	246,600	23.6	356,200	20.2	305,600	12.6	189,900	9.6	145,300	4.6	71,600	1.6	23,900	0.4	5,300	0.6	8,900	0.4	5,300	1,510,500
	Total: Eel River Hydrographic Unit		69,400		474,100		1,256,400		1,823,700		1,798,200		1,206,600		860,800		389,300		128,900		34,200		20,800		15,500	8,077,900

Ground Water Hydrology

The occurrence, nature, and movement of ground water do not always reflect the topographic conditions which define and separate adjacent surface water drainage areas. There exists a subsurface hydraulic connection between the lower reaches of the Mad River and the Arcata Plains ground water area, and similar geologic conditions occur throughout the entire Eureka area. This section discusses the ground water conditions for both the Eel River Hydrographic Unit and the Mad River-Redwood Creek Hydrographic Unit, under the generalized headings of (1) Upper Eel River drainage area and (2) Eureka area.

Upper Eel River Drainage Area

The three major ground water basins in the upper reaches of the Eel River are located in Round Valley, Laytonville Valley, and Little Lake Valley. These basins are shown on Plate 3, and are discussed separately in the following paragraphs.

Round Valley. Round Valley, shown on Plate 3, is located in northern Mendocino County, approximately 30 miles northeast of Willits, and is contained within the Round Valley Hydrographic Subunit. It is accessible by 30 miles of county road extending from the small town of Longvale on Highway 101, or by 85 miles of unpaved road extending west from Willows. Covelo is the only town within the valley.

The valley has an area of about 23 square miles, with dimensions of about 6 miles in a north-south direction, and 4 miles in an east-west direction. The valley floor slopes gently from northwest to southeast, and ranges in elevation from 1,400 to 1,330 feet. High, rugged hills encircle the valley and extend to 2,500 feet above the valley floor. The principal streams entering the valley are Mill, Short, Town, Grist, and Turner Creeks. They converge with Mill Creek in the southeastern part of the valley and flow easterly through a narrow canyon to the Middle Fork Eel River.

At present, ground water is essentially the only source of water for the valley. Development for irrigation has increased considerably in the past few years, and there are probably over 25 wells which are pumping water for irrigation. Total pumpage in 1954 was estimated to be about 2,000 acre-feet.

a. Geology. Round Valley is a down-faulted block or graben partially filled with alluvium of two different ages. Clark (8) suggests the valley is bounded on all sides by a complex set of faults, but surface evidence of faults has been destroyed by erosion and alluviation. After the down-faulting, sediments of Pliocene and Pleistocene age (older alluvium) were deposited in the valley. They were subsequently tilted slightly to the northwest, eroded, and recent alluvium was deposited on top of them.

Subsidence of the valley probably occurred repeatedly at times, creating lakes as indicated by the fine-grained sediments in the center of the valley which interfinger with and grade laterally into coarser alluvial sediments deposited by streams on alluvial fans around the edge of the valley. During periods when the lakes were filled or drained, stream deposits were laid down in the center of the valley, and are now aquifers containing water confined by the overlying fine-grained lake deposits.

Bedrock which underlies and surrounds the alluvium in Round Valley has been assigned to the Franciscan group of Jurassic-Cretaceous age. Rock types include sandstone, shale, serpentine, and greenstone. The bedrock is generally impervious, although minor amounts of ground water are contained in sheared and fractured zones. No wells in the valley are known to obtain water from bedrock.

b. Older Alluvium. Older alluvium is exposed over an area of about two square miles in the southern end of the valley. The beds appear to dip about 5 degrees to the west or northwest, but the exact attitude is difficult to determine. In the outcrop area, the exposures consist of about 75 feet of silty gravel, sand, silt, clay, and siltstone. Some of the clay layers are 4 to 6 feet thick. The permeability of the exposed beds appear to be very low, but unexposed portions may be more permeable. The older alluvium probably contains gravel lenses which may transmit considerable water, but they probably do not have good hydraulic continuity with recharge areas. The overall appearance of the outcrops is that the formation is generally fine-grained, has low permeability, and will contribute only very low yields to wells.

The thickness of the older alluvium is apparently over 400 feet in some places. Well 22/12-19B1, 860 feet deep, ended in older alluvium, and the log of well 22/12-19G2, 508 feet deep, suggests that the top of the older alluvium is at a depth of either 410 or 450 feet. A test well drilled by the U. S. Bureau of Reclamation at 22/12-6L penetrated probable older alluvium to a depth of about 580 feet.

c. Younger Alluvium. The younger alluvium forms the only important ground water reservoir in Round Valley. It consists of alluvial fans, flood plain deposits, stream channel deposits, and lake-bed silts and clays. Near the margins of the valley, the alluvium consists of coarse, poorly sorted material. Toward the center of the valley, the material generally becomes progressively finer with better sorting. In the center, the clay layers act as confining layers, and artesian conditions are present over nearly half of the valley.

During the deposition of the younger alluvium, aquifer material was spread over a considerable portion of the valley, rather than being restricted to the margins. This is the case in parts of the 100 to 200-foot depth zone over much of the valley, and also in the 50 to 100-foot interval in the western half of the valley. In the center of the valley, the sand is often thick and fine-grained, and has caused much difficulty in wells. Several wells have been lost by sanding, and many artesian wells are allowed to flow continuously because of danger of sanding-in if capped. Different well construction methods would probably reduce the danger of sanding.

The highest producing wells are located in the central and southwest portion of the valley. Well 22/12-6L3, drilled in

1959 as a test well by the U. S. Bureau of Reclamation, yields 1,250 gpm with a 70-foot drawdown. Except for this well, the high yielding wells are located closer to the valley margin than to the center of the valley. Wells 22/12-19B1 and K1 each yielded 1,000 gpm with 100-foot drawdown when drilled in 1956, but they presently yield only about 700 gpm. Well 22/12-18E, drilled in 1961, yields 850 gpm with about 100-foot drawdown. The average yield of all irrigation wells in the valley is about 400 gpm.

d. Ground Water. Ground water occurs in both confined and unconfined conditions in Round Valley. Confined ground water generally occupies the central portion of the valley, and occurs as a result of overlapping of the fine-grained deposits on the coarser alluvium or aquifer material. The highest heads are in the northwest part of the valley, where, in 1958, well 22/12-6L2 was reported to have had a head of 25 feet above the ground surface during the winter and spring. However, throughout most of the confined areas the pressure surface varies from 5 to 10 feet above ground level during the winter and spring, and is below ground surface during the summer and fall.

Unconfined water occurs in a belt about 1 mile wide around the margin of the valley, and also occurs locally in shallow zones overlying the confined water. Seasonal fluctuations of water levels are greatest in the western portion of the unconfined area near the margin of the valley. Well 22/12-19M1 has an average annual fluctuation of about 20 feet -- from about 5 feet to 25 feet below ground surface. Well 22/13-1L1, during the period 1951 to

1958, fluctuated from about 10 feet to 35 feet below the ground surface. These are near to the maximum observed amounts of seasonal water table fluctuations. Generally, fluctuations in other wells are less, and are at a minimum in the southeastern part of the valley where ground water is naturally discharged. Previous reports state that there is no evidence of a long-range lowering of water levels due to pumping. Complete recovery of water levels at the start of recharge periods indicates that the present amount of recharge is limited by the available storage, and it appears that the annual recharge could be increased if water levels were lowered by additional pumping.

The source of the ground water in Round Valley is rainfall upon the drainage basin. Recharge occurs principally along the stream channels and alluvial fans along the northern and western margins of the valley. Elsewhere, recharge is limited by perennially high water levels and near-surface deposits of low permeability.

Water level contours prepared by the U. S. Geological Survey show the general direction of ground water movement is from west to east, then to the southeast, indicating that the greatest portion of the recharge occurs along the western margin of the valley. Ground water moves toward the lower part of the valley, where it discharges into Mill Creek and is also taken into the atmosphere by evapotranspiration.

e. <u>Recharge Potential</u>. Surface water resources are derived from rainfall, giving rise to numerous streams which enter and cross the valley. Although all these streams are not perennial, many flow for most of the year. Alluvial deposits in the forebay areas appear sufficiently permeable to allow rapid infiltration to the water table around the edge of the valley. From these areas ground water can move through moderately permeable zones to the central pressure area.

The amount of recharge which presently occurs each year in Round Valley is limited by the available storage space in the ground water reservoir. Annual recharge is estimated to be about 15,000 acre-feet. Hydrographs of wells show that the ground water reservoir is filled early in the recharge period, and the remainder of the potential recharge water is refused. Greater utilization of the valley's ground water resources would eliminate this condition. Also, lowering of the water table would result in a decrease in natural losses of ground water by evapotranspiration.

f. Storage Capacity. Quantitative estimates of the amount of ground water stored within water-yielding materials were made by analysis of 41 drillers' logs of wells in the valley. The average specific yield of the zone 10-200 feet was found to be 9.5 percent, and the average specific yield for each interval within this zone varied only slightly from this value. Table 57 shows the specific yield and estimated usable storage capacity for each interval. A surface area of 15,000 acres was used, as this is approximately the area which is underlain by alluvium over 200 feet thick.

As previously stated, usable storage capacity was estimated by assigning a specific yield of zero to clay and related materials. Zero is considered an approximation of short-term yield of clay. The following table shows the estimated usable storage capacity for each depth interval, and the total for the 10-200-foot zone.

TABLE 57

USABLE STORAGE CAPACITY TO A
DEPTH OF 200 FEET IN ROUND VALLEY

Depth interval (feet)	Estimated average specific yield (percent)		Usable storage capacity (acre-feet)
10-50	7.5		45,000
50-100	8.0		60,000
100-150	7.9		59,300
150-200	9.0		67,500
		Total	231,800
		Rounded	230,000

Since the water level in the spring is about 10 feet, or higher in places, the usable storage capacity currently appears to be full and available to wells for extraction. Total storage capacity for the same area and depth zones were also determined for comparison by assigning a specific yield of 3 percent to clay. This amount is approximately 30,000 acre-feet greater than usable.

In addition to the 230,000 acre-feet of ground water above a depth of 200 feet, there is probably at least as much below. The younger alluvium is about 750 feet thick in the center of the valley. Only three logs are available for wells deeper than 200 feet; consequently, the specific yield of the material below that depth is not well known. However, it is roughly estimated that there are at least 200,000 acre-feet of ground water stored in the younger alluvium below a depth of 200 feet.

g. Pumping Costs. Costs to pump ground water have been computed for two parts of Round Valley -- the area where the ground water is confined, and the area where it is not confined. In each case, the costs are based on a typical, properly designed well in that location. In the confined area, the costs are based on well 22/12-6L3 which was drilled by the U. S. Bureau of Reclamation in 1959 to a depth of 660 feet. The well is located near the geographic center of the valley and southwest of the center of the confined area. The cost is estimated to be about $7.50 per acre-foot, assuming a use factor of 30 percent. Table 58 shows how cost varies with the use factor for a pump lift of 195 feet and with a pumping lift increased by 50 feet.

In the unconfined area, pumping costs will be somewhat higher than in the confined area because of the greater depth to water and consequently the greater lift required. Based on a well 450 feet deep, yielding 650 gpm with a pumping lift of 210 feet, the cost will be about $9 per acre-foot, with a 30 percent use factor. Table 59 shows how the cost varies with the use factor and with increased pumping lift. This cost applies to all the unconfined area in the valley except the southeastern part. Here, the older alluvium is at a shallow depth, fine-grained material predominates, and well yields would be low. Cost to pump water in this area would be considerably higher than the average cost in the remainder of the unconfined area. The total annual costs shown in Table 59 were determined by the procedure outlined on page 50.

TABLE 58

ESTIMATED TOTAL ANNUAL COST OF PUMPING CONFINED GROUND WATER IN ROUND VALLEY

(In Dollars per Acre-Foot)

Pumping use factor (%)	Total pumping lift* 195 feet	Total pumping lift* 245 feet
10	15.5	18.0
20	9.5	11.5
30	7.5	9.0
40	6.0	7.0

*Costs include facilities to deliver water at 50 psi at pump discharge.

TABLE 59

ESTIMATED TOTAL ANNUAL COST OF PUMPING UNCONFINED GROUND WATER IN ROUND VALLEY

(In Dollars per Acre-Foot)

Pumping use factor (%)	Total pumping lift* 210 feet	Total pumping lift* 260 feet
10	20.0	23.0
20	12.0	14.5
30	9.5	11.0
40	7.5	9.0

*Costs include facilities to deliver water at 50 psi at pump discharge.

Laytonville Valley. Laytonville Valley, in the Laytonville Hydrographic Subunit, is located in the north central part of

Mendocino County, 46 miles northwest of Ukiah, along Highway 101. The small town of Laytonville is the only town within the valley.

The valley has an area of about 12 square miles -- 9 miles long in a northwesterly direction and up to 2.2 miles wide. The elevation of the valley floor ranges from 1,600 to 1,700 feet. On the west and south, the valley is bordered by low, rolling hills 200 to 300 feet higher than the valley floor, while the remainder of the valley is surrounded by steep hills up to 1,500 feet higher in elevation than the valley floor.

Two separate stream systems drain the valley. Ten Mile Creek drains the central and northern portions in the Laytonville Hydrographic Subunit, flows generally northwest, and is a tributary to the South Fork Eel River. Long Valley Creek, in the Outlet Creek Hydrographic Subunit, drains the extreme southern portion of the valley, and flows southeast into Outlet Creek, which in turn flows into the Middle Fork Eel River. Several small perennial streams flow into the valley from the surrounding hills.

Ground water supplies about one-half of the water used in the valley. The town of Laytonville obtains its water supply from a well which yields about 700 gpm. Numerous low capacity, generally shallow wells and springs provide domestic and stock water for those people in the valley who are not served by the municipal water system. Total ground water pumped in 1954 was estimated by the U. S. Geological Survey to be about 900 acre-feet.

a. Geology. Laytonville Valley is an alluviated valley formed by faulting and erosional processes in bedrock of Cretaceous and Jurassic age. The alluvium consists of two separate units -- older alluvium which has been eroded, terraced, and faulted, and younger alluvium which partially covers the older alluvium and floors the central portion of the valley. The areal extent of the alluvial deposits is shown on Plate 3.

The bedrock underlying the valley is the Franciscan Formation, and consists principally of consolidated marine sedimentary rocks which include sandstone, shale, mudstone, and some limestone. Volcanic rocks, serpentine, and some chert are associated with the sedimentary rocks. In this area the bedrock stores and yields significant quantities of ground water from sheared and fractured zones. Several wells in the valley derive their water entirely from bedrock, and numerous springs around the valley edge emanate from bedrock. The largest spring, Pinches Spring, flows at about 200 gpm throughout the year.

The older alluvium consists of poorly pervious, unconsolidated to poorly consolidated clayey and sandy gravel within a predominant section of fine-grained material. It outcrops west of the valley over an area of about 4 square miles. In its outcrop area, it is about 50 feet thick, but thickens to the east and is probably about 200 feet thick along the axis of the valley.

Wells in the older alluvium yield only enough water for domestic and stock watering purposes. It is doubtful that the older alluvium has high enough permeability to supply water to irrigation wells.

The younger alluvium occurs along the central portion of the valley, and consists of poorly sorted sand, gravel, silt, and clay, with local thick interconnected bodies of highly pervious sand and gravel. The only high-yielding wells in the valley are located near the center of the valley, and apparently obtain most of their water from highly pervious gravels in the younger alluvium, although the wells extend into the older alluvium. Well 21N/15W-13G1 yields 1,000 gpm with a 100-foot drawdown, and well 21N/15W-13B1 yields 700 gpm with an 18-foot drawdown. Other wells drilled in the younger alluvium away from the axial part of the valley have only low to moderate yields. The location of future high-producing wells is believed limited to the central portion of the younger alluvium. The younger alluvium is estimated to be about 150 feet thick.

b. Ground Water. Ground water occurs in all three rock units in the Laytonville Valley area. Wells which derive their water from bedrock often flow, generally because the water is confined by the alluvium, but occasionally because of the effect of natural gas in the water. Ground water in the older alluvium is unconfined in its outcrop area, but it is confined or semiconfined where it is overlain by the younger alluvium. The water in the younger alluvium is unconfined to semiconfined, depending on the amount of overlapping of coarse material by fine-grained sediments.

The depth to ground water in the valley varies from 0-39 feet, but the average depth is less than 10 feet. The water table roughly follows the topography of the ground surface, but several wells in the valley flow throughout the year. Seasonal fluctuations of water levels vary from 50-15 feet in the younger alluvium, depending on their location, and up to 17 feet in the older alluvium. The fluctuations are probably related to natural discharge rather than pumping withdrawal. There is no evidence of long-term decline of water levels.

The source of the ground water in the valley is the precipitation which falls on the valley floor and on the areas drained by streams tributary to the valley. Infiltration of precipitation, and percolation from permeable streambeds, supply nearly all the ground water increment, but some water is probably added to the ground water body by underflow from the bedrock. The ground water moves generally from the valley margins to points of discharge along Ten Mile Creek and some of its tributaries, and Long Valley Creek.

c. Recharge Potential. With a high annual average rainfall, and a moderate permeability of the younger alluvium, a relatively high potential for replenishment of ground water supplies in the valley floor area is believed to exist. The fluctuation of the ground water table in 1954 averaged about 9 feet, based on 7 well hydrographs. In the younger alluvium, which has an area of about 3,300 acres and an estimated specific yield of 13 percent, the change in ground water storage caused by the 1954 water table fluctuation was about 5,000 acre-feet. Records of water levels in wells suggest that the complete recovery in ground water storage normally occurs within the first three months of the recharge cycle. The total recharge cycle in the area lasts about seven months. If ground water withdrawals were increased sufficiently to maintain the water levels well below ground surface throughout the year, recharge could occur throughout the entire recharge period and amount to over twice the present change in storage, or over 10,000 acre-feet.

d. Storage Capacity. The total ground water storage capacity has been estimated for approximately 4,000 acres of younger and older alluvium. Three zones of diminishing volume and area with increasing depth are estimated as follows:

Younger Alluvium

2,900 acres - Thickness 10-50 feet
900 acres - Thickness 50-100 feet
300 acres - Thickness 100-120 feet

Older Alluvium

900 acres - Thickness 10-100 feet

Based on estimated specific yields of materials described in eight well logs, the total storage capacity of younger alluvium between 10 and 120 feet is approximately 22,600 acre-feet.

The total storage capacity for 900 acres of older alluvium between 10 and 100 feet is roughly estimated as 4,000 acre-feet.

The usable storage capacity was estimated by assigning a short-term specific yield of zero to clay and related materials, instead of three as used in the estimate of the total storage capacity. The storage capacity of the older alluvium is not included as usable storage, since considerable clay is present and, consequently, permeability is low. Development of ground water in the older alluvium will be limited to low capacity domestic and stock wells. On this basis the usable storage capacity in Laytonville Valley, from a depth of 10 feet to 120 feet, is about 21,000 acre-feet, as shown in Table 60.

TABLE 60

STORAGE CAPACITY OF YOUNGER ALLUVIUM
TO A DEPTH OF 120 FEET IN LAYTONVILLE VALLEY

Depth interval (feet)	Estimated short-term specific yield (percent)	Usable storage capacity (acre-feet)
10-50	12	13,800
50-100	15	6,700
100-120	16	960
	Total (rounded)	21,000

e. Pumping Costs. Pumping costs have been estimated for a well yielding 650 gpm with a lift of 50 feet plus the additional lift required for sprinklers. These are considered to be about the average yield characteristics for a well located near the center of the valley. Elsewhere in the valley, wells will probably yield less and pumping costs will be higher. Based on this average well, the cost to pump ground water for irrigation will be about $6.50 per acre-foot with a 30 percent use factor. Table 61 shows how the cost varies with the use factor and with increased pumping lift. These costs were determined by the procedure outlined on page 50.

TABLE 61

ESTIMATED TOTAL ANNUAL COST OF PUMPING
GROUND WATER IN LAYTONVILLE VALLEY

(In Dollars per Acre-Foot)

Pumping use factor (%)	Total pumping lift*	
	170 feet	220 feet
10	13.5	17.0
20	8.5	11.0
30	6.5	8.5
40	5.5	7.0

*Includes facilities to deliver water at 50 psi at pump discharge.

Little Lake Valley. Little Lake Valley is located in the Outlet Creek Hydrographic Subunit in the central part of Mendocino County, 22 miles north of Ukiah. U. S. Highway 101 and the main line of the Northwestern Pacific Railroad pass through the valley. The town of Willits is located in the west central portion of the valley.

The valley is a northwesterly trending, nearly flat alluvial valley about 6 miles long, and contains an area of about 17 square miles. The valley floor has an elevation of about 1,500 feet above sea level at the south end, and slopes quite gently to elevation 1,325 in the north. It is surrounded by dissected foothills and steep ridges which rise up to 1,500 feet above the valley floor. Principal streams flowing into the valley are Davis, Haehl, Baechtel, Broaddus, and Willits Creeks. They join in the central and northern part of the valley and form Outlet Creek, which drains the valley and flows into the Eel River.

Water for the valley is obtained from a combination of surface water and ground water. The municipal water supply for the town of Willits is obtained from Morris Reservoir on Davis Creek, in the southeastern part of the valley. Present irrigation wells are located only in the west-central and northern portions of the valley. The U. S. Geological Survey estimated that the total amount of water pumped in the valley in 1954 was less than 500 acre-feet. Numerous low capacity domestic and stock wells provide water in areas not served by the municipal water system.

a. Geology. Little Lake Valley is an intermountane, gently sloping, alluviated valley, formed by structural and erosional processes in bedrock of Cretaceous and Jurassic age. The alluvium consists of two separate units -- older alluvium of Pliocene to Pleistocene age which has been dissected, folded, and faulted, and younger alluvium of Recent age which overlaps the older alluvium and floors the major portion of the valley.

The bedrock is probably part of the Franciscan Formation, and consists predominantly of consolidated marine sedimentary rocks which include sandstone, graywacke, mudstone, shale, and some bodies of chert. Also, bodies of schist, greenstone, and serpentine are associated with the sedimentary rocks. The bedrock contains at least a small amount of water, as a few domestic wells around the margins of the valley obtain their water from it. The bedrock is, in places, extensively sheared and fractured, and wells probably obtain their yield from these zones. Water from the bedrock is commonly associated with considerable quantities of natural gas, and the water is occasionally mineralized.

The older alluvium consists of clay, diatomaceous shale, silt, sands, and poorly sorted gravels. It outcrops over an area of about 5 square miles and forms low, rolling hills in the southern portion of the valley. In the outcrop area, the beds dip up to 30-40 degrees, usually to the northeast or northwest. They indicate minor folding along a north-south axis, with a plunge to the north. The older alluvium disappears to the north under the younger alluvium in the central portion of the valley, but it continues to outcrop along the extreme eastern edge of the valley. The attitude of the older alluvium where it is overlain by younger alluvium is not well known, but the beds probably have a lower dip and may be nearly flat-lying. The older alluvium probably has a maximum thickness of about 1,500 feet.

The older alluvium is water-bearing, but it generally yields low quantities to wells since the material is predominantly fine-grained and compact. The log of well 18/13-20P2, 95 feet deep, shows that 25 feet of gravel with sand, interbedded with clay, was penetrated. When drilled in 1947, the well flowed at 250 gpm, but decreased to about 15 gpm by 1954, possibly indicating poor continuity of the aquifer with a source of recharge. This is most likely the situation in nearly all the older alluvium. Although fairly good aquifers are present, they are enclosed by fine-grained material. Based on the yields of existing wells, and the general appearance of the outcrops, the older alluvium probably will not yield enough water for irrigation wells.

The younger alluvium covers an area of about 12 square miles in the main part of the valley. It consists of layers and lenses of pervious gravels and sand which are usually confined by relatively impervious silts and clays. In the western and northwestern portions of the valley, the gravels are quite thick and form good aquifers. According to the log of well 18/13-18H1, the gravels are 182 feet thick, extending from 68 feet to 250 feet. The logs of wells 18/13-6H1 and 6Q1 show the thickness of a gravel layer to be 35 feet and 45 feet. In the southern and eastern portions of the valley, the gravels are much thinner, and consequently form poor aquifers. The total thickness of the younger alluvium is at least 250 feet, and possibly more in some areas. Well 18/13-18H1 apparently penetrated 250 feet of younger alluvium before entering the underlying material.

Wells in the younger alluvium yield up to 950 gpm and have specific capacities ranging up to a maximum of 100 gpm per foot of drawdown. The highest yielding wells in this valley are in Sections 6, 7, 18, and 19. The average yields and specific capacities of the four most productive wells in these sections are 450 gpm and about 13 gpm per foot of drawdown, respectively. Three of these wells flow during at least part of the year. Elsewhere in the valley, yields are lower and specific capacities are much lower. High capacity wells in the valley are probably limited to the northern and west central portions of the valley.

b. Ground Water. Ground water occurs in all three of the geologic units in the valley; however, only a few wells obtain water from the bedrock, and the yields are small. Water in the bedrock is probably unconfined except where it is overlain by alluvium, in which case it is probably confined.

In the older alluvium, water is usually confined in thin lenses of permeable material enclosed by fine-grained, poorly pervious sediments. Wells in the older alluvium in the southern part of the valley often flow, and have artesian heads up to 25 feet above the land surface. In general, the heads show considerable variation in short distances, since the permeable zones have poor connection with each other.

The water in the younger alluvium is both confined and unconfined. In the central and northern part of the valley, there is a shallow water table and a deep confined aquifer, as shown by a comparison of water levels and pumping relationships between nearby deep and shallow wells. Irrigation well 18/13-8L2, 96 feet deep, can be pumped heavily without affecting the water level in well 18/13-8L1, 18 feet deep and 450 feet away. Several other pairs of wells show the same relationship in the confined area. Deep wells in the northern part of the valley have artesian heads up to 6 feet above the ground surface, and flow at rates of up to 200 gpm. Elsewhere in the valley, wells exist which flow only during part of the year.

The depth to ground water varies according to the location in the valley. In the northern end, in the younger alluvium, water levels are close to the ground surface most of the year, and in the winter and spring the area contains seeps and swampy areas. Years ago, the north end of the valley contained a lake during the late winter and spring, but this condition has been partially alleviated by improved drainage. The maximum depth to water is about 70 feet in the older alluvium, but the average is much less. In the younger alluvium, the average depth to the water table during the year is probably slightly over 10 feet. Only two wells in the younger alluvium show depths greater than 25 feet to water.

Seasonal water level fluctuations also vary somewhat according to location, but the fluctuations are relatively small. Shallow wells show the least fluctuation, and deep wells tapping confined aquifers show the greatest fluctuation. During 1954, the fluctuation in well 18/13-18H2, which is 14 feet deep, was 6 feet. In well 18/13-8L2, 96 feet deep, the fluctuation was 10 feet during the same period. Artesian pressures in the southern and central portions of the valley have been somewhat lowered over the years.

Recharge occurs principally by percolation of runoff through permeable stream channels and alluvial fans around the valley edge, but some recharge may occur by seepage from the underlying bedrock. Some recharge to the younger alluvium probably occurs by upward percolation from the underlying older alluvium. The principal recharge areas for the younger alluvium are near its southern and eastern margins. The ground water moves to the northern portion of the valley where it is forced to the surface, discharged into Outlet Creek, and consumed by evapotranspiration.

c. Recharge Potential. At the present time data on ground water use and historical records on water levels are too limited to evaluate recharge conditions. A large portion of the waters available for replenishment is rejected due to lack of storage space. With an annual rainfall of 50 inches and a high degree of permeability in the younger alluvium, a good potential exists for replenishment under conditions of even greater use. If ground water levels were lowered, it appears that a considerably greater volume of water than is presently used could be replenished.

d. Storage Capacity. The ground water storage capacity of Little Lake Valley has been estimated only for the younger alluvium. The ground water storage capacity was not estimated for the older alluvium because it will not yield enough water for irrigation wells, although it does provide water to many low capacity wells.

The usable ground water storage capacity is summarized in Table 62.

TABLE 62

GROUND WATER STORAGE CAPACITY TO A DEPTH OF 200 FEET IN LITTLE LAKE VALLEY

Depth interval (feet)	Area (acres)	Thickness (feet)	Estimated average specific yield (percent)	Usable storage capacity (acre-feet)
10-50	6,400	40	4.7	12,000
50-100	5,100	50	14.7	37,500
100-150	3,200	50	20.1	32,200
150-200	1,280	50	15.5	9,900
			Total (rounded)	91,600

e. Pumping Costs. Existing wells in Little Lake Valley vary greatly in their characteristics. The characteristics of all the irrigation wells are not known, but of those which are known, the yields range between 100 and 950 gpm, and the specific capacities range between about 1 and 100 gpm per foot of drawdown. Pumping costs are based on an average well with a yield of 600 gpm, pumping lift to ground surface of 45 feet, and a depth of 250 feet, the maximum thickness of the younger alluvium. Based on this average well, the cost of pumping ground water with the added head of 120 feet for operation of sprinklers will be about $7 per acre-foot if the well is operated 30 percent of the time. Table 63 shows how the cost varies with the head and use factor.

This cost is applicable only to wells in the west-central and northern part of the valley. To the east, the gravels are replaced by a thick section of poorly pervious clay with only thin lenses of sand and gravel.

TABLE 63

ESTIMATED TOTAL ANNUAL COST OF PUMPING GROUND WATER IN LITTLE LAKE VALLEY

(In Dollars per Acre-Foot)

Pumping use factor (percent)	Total pumping lift*	
	165 feet	215 feet
10	15.0	20.0
20	9.5	12.5
30	7.0	9.5
40	6.5	7.5

*Costs include facilities to deliver water at 50 psi at pump discharge.

Eureka Area

The Eureka area is located in the west-central part of Humboldt County along the coast.

The area extends for 30 miles along the coast in a northeast direction from the town of Ferndale to the town of Crannell, and up to 16 miles inland. The area includes the alluvial valleys of the Eel, Mad, and Van Duzen Rivers, and contains the vast majority of the irrigable land near Eureka, together with those portions of the adjacent upland areas which are underlain by water-bearing sediments. Within the area three ground water basins have been identified and named. These are the Mad River Valley, Eureka Plains, and Eel River Valley, in the northern, central, and southern portions of the Eureka area, respectively. The basins are further subdivided into smaller areas.

Along the coast, the stream valleys are broad, but narrow quite rapidly upstream. They are separated by elevated, nearly flat or dissected terraces. The northeast-trending shoreline has a well-developed sand beach along its entire length. Farther inland, beyond the terraces and east of the Eureka area, rugged mountains and steep, narrow stream valleys dominate the topography. The area covered by this section on ground water ranges in elevation from sea level up to about 500 feet.

One of the more obvious topographic features of the area is Humboldt Bay, a landlocked harbor which extends for a distance of 12 miles parallel to the ocean. The harbor is separated from the ocean by a narrow sand spit which is continuous except for a narrow channel connection to the ocean near the south central part of the bay. The northern portion, known as Arcata Bay, is up to 4 miles wide and receives the runoff from Freshwater and Jacoby Creeks. The southern portion of Humboldt Bay is about 2 to 5 miles wide, and is known as South Bay. Salmon Creek and Elk Creek discharge into South Bay. These streams, and many sloughs extending from the bay, are tidal for up to 2 miles from their mouths.

Mad River, the northernmost and second largest stream in the area, discharges into the ocean 5 miles north of Humboldt Bay. It is tidal for at least 1 mile inland. The Arcata Plain lies between the Mad River and Humboldt Bay. It is dissected by flood stage channels of the river up to 20 feet deep. Blue Lake Valley, about 1 mile wide and 4 miles long, lies along the Mad River

7 miles inland from the ocean. Upstream and downstream from this valley, the Mad River flows in narrow canyons entrenched into consolidated nonwater-bearing rocks.

Eel River, the largest stream in the area, discharges into the Pacific Ocean 5 miles south of Humboldt Bay. The river is under tidal influence for about 4 miles inland, and the flood plain near the coast is cut by many tidal sloughs. The alluviated portion of the valley at the mouth is about 8 miles wide and narrows to a width of 1.1 mile at the confluence of the Eel and Van Duzen Rivers, 11 miles inland. Upstream from the confluence, both rivers flow in narrow valleys.

At present, ground water provides an important part of the water used in the Eureka area. The U. S. Geological Survey estimated that in 1952 over 250 irrigation wells supplies water to about 12,000 acres of land, almost all irrigated pasture, and that the pumpage for irrigation uses alone exceeded 12,000 acre-feet. About 80 percent of this was used in the Eel River and Mad River Valleys. The total pumpage for all uses was estimated to be about 15,000 acre-feet.

Geologic Formations. The geologic formations present in the Eureka area are predominantly sedimentary, and range in age from Jurassic to Recent. Ground water is obtained from wells penetrating deposits of Pliocene to Recent age.

The oldest rocks exposed in the Eureka area are undifferentiated sedimentary and metamorphic rocks of the Franciscan and Yager Formations of Jurassic and Cretaceous age. They are exposed along the east and south edges of the area, and underlie the area at great depth. They are essentially nonwater-bearing.

The Wildcat group of Tertiary age overlies the Franciscan and Yager Formations in most of the area and outcrops over a large part of the area. North of the Eel River Valley, the Wildcat group has not been differentiated except for the uppermost formation, the Carlotta, but to the south it has been differentiated into five formations which vary in age from Miocene to Pleistocene. The lower three, the Pullen, Eel River, and Rio Dell, are predominantly marine siltstone and claystone, while the upper two formations, the Scotia Bluffs and Carlotta, are predominantly nonmarine sandstone. Of this Wildcat group, only the Carlotta Formation is important as an aquifer. Wells which penetrate it yield up to 1,200 gpm and often are flowing at the surface. The Scotia Bluffs Formation, which underlies the Carlotta, contains a few thin sand and gravel beds which may be water-bearing, but they have not been exploited. The remaining portion of the Wildcat group is fine-grained and has negligible potential for the development of ground water.

Overlying the Wildcat group, but present in only part of the area, is the Hookton Formation of Pleistocene age. It is extensive on the seaward slopes of the hills from the Van Duzen River to the northern end of the Eureka area. It unconformably overlies, and locally is in fault contact with, the Wildcat group and the Franciscan Formation. It consists of up to 640 feet of loosely consolidated clay, silt, sand, and gravel. The material becomes progressively finer grained to the north. The Hookton is the second most important reservoir and source of ground water in the Eureka area. North of the Mad River, in the Dows Prairie area, it is the only source of ground water. Some of the wells in the Hookton are flowing, notably in the area south of Arcata, but the majority of the wells tap unconfined or partially confined water. They yield up to about 800 gpm. Most of the wells in the Hookton Formation have difficulty with sanding.

Terrace deposits, Pleistocene in age, are present along the Eel and Van Duzen River Valleys, and to a lesser extent along the Mad River Valley, and smaller streams. Eight steplike terrace levels have been mapped to the north of the Van Duzen River and east of Hydesville, five terrace levels have been mapped along the Eel River near Metropolitan. All the terrace deposits are grouped together in this report. The maximum thickness of the deposits is probably about 100 feet. The terrace deposits are an important source of ground water in some areas, especially near Metropolitan, and to a lesser extent around Hydesville and Rohnerville. Well 2N/1W-35O1, near Metropolitan, yields 650 gpm with a drawdown of 7 feet, but this is exceptional for the terrace deposits.

Alluvium of Recent age underlies the vast majority of the irrigable land in the area, and is the most productive geologic unit in the Eureka area in terms of both yield to wells and total ground water produced. The alluvium underlies the flood plains of the Eel, Van Duzen, and Mad Rivers, and the smaller streams in the area. In the three largest river valleys, it typically consists of many intersecting, shoestring gravel channels up to 40 feet thick, surrounded by finer grained flood plain deposits. The upper 10 feet commonly consists of soil, sand, silt, and clay. The maximum thickness of the alluvium is not known, but it may be as much as 200 feet near the mouth of the Eel River. In the flood plains of the smaller streams and tidal lands near the bay, the alluvium contains little gravel, and consists mostly of silt and clay. As a result, the alluvium in the valleys of the smaller creeks and larger valleys near the bay and ocean commonly has little usable storage capacity, and the few existing wells have low yields. The gravel aquifers in the major stream valleys are highly pervious and are often slightly confined by the overlying fine-grained material. Water is reported to rise somewhat above the level where it was first encountered during drilling. Most of the wells are less than 70 feet deep, and do not penetrate the entire thickness of the alluvium. Yields of wells in the alluvium range up to 1,200 gpm, and specific capacities range from 20 to 600 gpm per foot of drawdown.

Geologic Structure. The major structural features of the Eureka area are east-west trending folds which plunge toward the ocean. They deform the Hookton and all older formations, and are the reason for the existence of flowing wells in the synclines and also in the direction of the plunge of the syncline. Because of the confining layers and the ground water gradient, fresh water exists in the Hookton and Carlotta Formations beneath alluvium which has been contaminated with salt water. At least 10 wells, most of which are flowing, obtain fresh water from aquifers beneath areas intruded by salt water.

The most prominent fold in the area is the west-plunging syncline in the Eel River Valley. North of Eureka, the structure is more obscure, but artesian wells exist along the bay and near the mouth of the Mad River, so the beds are apparently dipping or plunging toward the west. The area appears to have been warped into a number of small west to northwest trending folds plunging toward the ocean.

Many faults are present in the area, some of which have had recent movement. The faults do not appear to affect the movement or occurrence of ground water.

Eel River Valley. The Eel River Valley area includes the lower 8 miles of the Van Duzen River Valley and the Eel River Valley from the ocean upstream to 5 miles above its confluence with the Van Duzen River. The water-bearing formations in this area form the largest ground water basin in the Eureka area. Ground water pumpage is estimated to be over 10,000 acre-feet per year. Ground water in storage is considerably larger than in either Eureka Plains or Mad River Valley.

The geologic formations in this basin include alluvium, terrace deposits, the Hookton Formation, and the Carlotta Formation. The major portion of the valley is underlain by alluvium consisting of sand and gravel. The Hookton and Carlotta Formations underlie the alluvium and are exposed in surrounding hills to the north and south. The Eel River syncline, the most significant structural feature in the Eureka area, trends parallel to the length of the valley and plunges westward beneath the ocean.

In the alluvial material, ground water occurs in unconfined, highly pervious gravels which have good hydraulic continuity with the river. The gravel aquifers occur at variable depths, usually 10 to 20 feet below the ground surface, and are up to 40 feet thick. They apparently are intersecting shoestring-like channel deposits surrounded by fine-grained floodplain deposits. The total thickness of the alluvium in places is probably up to 200 feet. The depth to ground water in the alluvium ranges from about 3 feet to 20 feet, with an average depth of 10 to 12 feet. Average wells are less than 50 feet in depth and yield about 400 gpm with lifts of 20 to 30 feet. Specific capacities range up to 600 gpm per foot of drawdown. The most productive well known, 2N/1E-161 located on Yager Creek, reportedly yields 1,200 gpm with 2 feet of drawdown.

In addition to the ground water in the alluvium, there is a large supply, mostly undeveloped, in the underlying Hookton and Carlotta Formations. West of Ferndale, near the ocean, wells 3N/2W-32N1 and -32Q1 are drilled through the alluvium into the Carlotta Formation and yield 1,200 gpm each. Both wells are flowing, and in 1959 yielded water with 200 ppm chloride. In 1961, the chloride content had increased to 411 ppm. The water in the overlying alluvium is too saline for use in irrigation. The geologic structure is favorable for other deep wells near the mouth of the Eel River. Well 2N/1W-7K1, located east of Ferndale, yields 500 gpm from the Carlotta Formation. Other wells near Ferndale produce from the Carlotta, since the overlying alluvium is poorly permeable in that area. The wells are up to 340 feet deep, and yield 200 to 500 gpm with lifts up to 70 feet.

Along the north edge of the Eel-Van Duzen River Valleys, a belt of terrace deposits, Hookton, and Carlotta Formations parallels the trend of the alluvium. The topography consists of irregular dissected uplands. The geologic structure is somewhat complex, but in general the beds dip toward the Eel River, with anticlines and synclines superimposed on this dip. The present irrigation development is small and is concentrated around Rohnerville, with a few wells near Hydesville and Fortuna. The wells are from 100 to 300 feet in depth and yield up to about 500 gpm from deep, confined gravels in the Carlotta Formation. In most of the wells, the water rises to within about 35 feet of the ground surface, and some wells flow continuously. Geologic conditions seem favorable for the development of additional wells in this area.

There are several existing industrial wells near Loleta. Well 3N/1W-18K1 is the deepest at 572 feet, and yields 640 gpm with 132 feet of drawdown. It produces from the Carlotta and is a flowing well. Other shallower wells in the near vicinity yield smaller amounts. To the north of Loleta, near Table Bluff, only a few poorly productive wells exist. Structure is unfavorable for good wells since the area is near the crest of an anticline. The depth at which water is encountered is reported to be about 300 feet.

In well 3N/1W-34J1, 496 feet deep, the depth to water fluctuates from 33 feet to 37 feet below ground surface between spring and fall. Most of the wells in the Hookton and Carlotta

Formations along the north edge of the Eel River Valley tap confined aquifers, and some of the wells flow. In those wells which are nonflowing, the depth to water varies with the location, but near Rohnerville the maximum depth is about 37 feet, and the fluctuation during the year is usually less than 5 feet. Shallow wells near Rohnerville obtain water from the terrace deposits. The depth to water in these wells varies from about 10 feet up to 27 feet. The amount of fluctuation is not known.

Ground water in the Eel River Valley is usable for irrigation purposes, except in the tidal influence area near the mouth of the Eel River where salt water has intruded the alluvium. Below the alluvium, confined ground water in the Hookton and Carlotta Formations have adequate pressure head to maintain the fresh-water-salt-water interference farther to the west.

Recharge to the alluvium and lower terrace deposits is by percolation from the Eel River, deep percolation of rainfall on the area, and probably minor subsurface inflow from the underlying Hookton and Carlotta Formations. The general direction of movement of ground water is away from the river and downstream toward the ocean for final discharge into the tidal estuaries of the Eel River. Water level contours indicate some seepage from adjacent deposits. The Hookton and Carlotta Formations are recharged by deep percolation of rainfall and the upland outcrop areas. In some parts of the valley, where the head in the confined aquifer is low due to pumping or other causes, some recharge to these formations may occur by seepage from the overlying alluvium. Movement is downdip in confined aquifers, to the areas where it is discharged either into the ocean and/or upward through the confining layers into the overlying alluvium.

The alluvium is capable of being recharged rapidly by the Eel and Van Duzen Rivers, since the gravel aquifers have good hydraulic continuity with the river channels. The aquifers in the alluvium are commonly overlain by fine-grained soil and flood plain deposits, so the percolation of rainfall is somewhat restricted. However, a sizeable portion of the recharge is due to percolation of rainfall, which averages about 40 inches per year.

The Hookton and Carlotta Formations apparently have a good recharge potential. They outcrop on three sides of the alluvium, and recharge of the portion underlying the alluvium can occur on at least part of all three sides. It is not known how far upstream the recharge area for the Carlotta extends.

a. Storage Capacity. Storage capacity has been computed only for the alluvium. Storage capacity of the upper terraces, Hookton and Carlotta Formations, has not been computed because of the lack of information. Also, the aquifers in the Hookton and Carlotta Formations near the ocean are subject to sea water intrusion and therefore are not being included in the estimated storage capacity.

In estimating the storage capacity of the alluvium, the Eel River Valley was subdivided into four storage units: (1) the tidal influence area, which has no usable storage capacity because of poor quality water; (2) the Lower Eel Valley; (3) the Middle Eel

Valley; and (4) the Upper Eel and Lower Van Duzen Valleys. The area south of the western part of Salt Creek and a line drawn between Arlynda Corners and Coffee Creek School is not included in the computation of storage capacity because of poorly permeable material and low storage capacity. Most of the alluvium is silt and clay, and existing wells produce water only from deeper aquifers. In the Lower Eel Valley Unit, the saturated thickness for storage capacity computations was assumed to be the interval between the average spring water level and sea level. Lowering the water level below sea level would, of course, invite further sea-water intrusion. In the Middle Eel Valley Unit, the saturated thickness was assumed to be the difference between the average spring water level and 15 feet below sea level. The saturated thickness in the Upper Eel and Lower Van Duzen Valleys Unit was assumed to be the distance between the average spring water level and the bottom of the alluvium. The following table shows the estimated storage capacity by subunits.

TABLE 64

GROUND WATER STORAGE CAPACITY
IN EEL RIVER VALLEY

Storage unit	Area (acres)	Saturated thickness (feet)	Estimated average specific yield	Storage capacity (acre-feet)	Number of well logs used
Lower Eel	6,900	10	20%	13,800	9
Middle Eel	7,500	35	24%	63,000	23
Upper Eel and Lower Van Duzen	7,400	40	20%	59,300	9
			Total (rounded)	136,000	

Utilization of this storage capacity in the Eel River Valley is largely dependent upon the extent to which the basin can be dewatered without encroachment of saline water. Assuming that ground water levels in the Lower Eel Storage Unit can be maintained at or above sea level, then ground water in storage below sea level in the upper portion of the valley can be utilized. However, lowering the water table below streambed elevation of the Eel River would induce a large amount of seepage from the river into the alluvium. This, of course, increases the yield of the basin, but it could also result in the percolation of the entire flow of the river during periods of extreme low flow. If it were assumed that entire depletion of streamflow for short periods of time was not desirable and that water levels in the alluvium should not be lowered so as to cause such a condition, the usable storage capacity would be a relatively small quantity.

b. Pumping Costs. Costs to pump ground water for irrigation have been computed for three areas in the Eel River Valley. The three areas are: (1) the alluviated areas where wells obtain water from the alluvium or lower terrace deposits; (2) alluviated areas where deep wells obtain water from aquifers underlying the alluivum, such as near Ferndale and near the ocean; and (3) the Fortuna to Hydesville area, where wells obtain water from the upper terrace materials, and the Hookton and Carlotta Formations. Costs include 55 psi required for operation of sprinkler irrigation systems. The cost of pumping water for irrigation is $6 per acre-foot with a 30 percent use factor for the first two areas, and assumes a well yielding 400 to 500 gpm with pump lift of 140 to 155 feet.

Table 65 shows how the cost varies with the use factor. For the third area, the cost is estimated to be $9 per acre-foot with a 30 percent use factor. This cost is based on a well yielding 475 gpm with a lift of 200 feet. Table 65 is applicable to this area also. Pumping costs were determined by the procedure outlined on page 50.

TABLE 65

APPROXIMATE TOTAL ANNUAL COST OF PUMPING
GROUND WATER IN EEL RIVER VALLEY

(In Dollars per Acre-Foot*)

Area	Pump lift*	Use factor 10%	20%	30%	40%
Alluvial and low terrace areas 1/	145	13	8	6	5
Upper terrace areas, Fortuna to Hydesville 2/	200	19	12	9	7

*Costs include facilities needed to deliver 55 psi at pump discharge.
1/ 400 to 500 gpm.
2/ 475 gpm.

Eureka Plains. The Eureka Plains Ground Water Basin occupies the area immediately east of Humboldt and Arcata Bays. It is subdivided into two areas, the Salmon Creek-Elk River area, and the Jacoby Creek-Freshwater Creek area.

1. Salmon Creek-Elk River Area. The Salmon Creek-Elk River area includes two alluviated stream valleys and a belt of dissected uplands extending from Table Bluff on the south to the drainage divide of Elk River on the north. The south portion of Humboldt Bay borders the area on the west. The area extends eastward to the

contact with the undifferentiated Wildcat group. It is approximately 9 miles long in a north-south direction and 4 miles wide.

Present development of ground water consists of one irrigation well in the Salmon Creek Valley, and two or three irrigation wells and at least four industrial wells in Elk River Valley. In addition, there are numerous domestic wells in both valleys and in the adjoining upland areas.

Geologic formations in the area include alluvium in the two major stream valleys, terrace deposits along portions of the edge of the alluvium, and the Hookton and Carlotta Formations underlying the recent material. Undifferentiated Wildcat material borders the area on the west, and probably underlies at least part of it.

The alluvium yields only very small quantities of water to wells. It consists primarily of clay and silt, and has low permeability. However, confined aquifers in the underlying Hookton and Carlotta Formations yield up to 800 gpm from wells about 400 feet deep. Most of these wells are flowing artesian, and some yield fresh water from aquifers underlying salt-water-contaminated alluvium. The Hookton and Carlotta Formations in this area consist mostly of fine sand with thin sandy gravel lenses. Considerable difficulty is experienced with sanding of wells, and because of this, several wells have been abandoned or are cleaned of sand periodically.

Geologic structure is apparently important in controlling the movement of ground water in the area. The structure consists of east-west trending folds plunging to the west, which deform the Hookton and Carlotta Formations. These folds are probably responsible for the presence of flowing wells which exist in the lower elevations in the troughs of synclines and on the flanks of the folds.

Ground water occurs in an unconfined condition in the alluvium at depths of less than 10 feet. Since the alluvium is poorly productive, few wells obtain water from it. In the underlying Hookton and Carlotta Formations, the ground water is generally confined.

The general direction of movement of ground water is from east to west. The confined aquifers are probably recharged by rainfall on the outcrop area, and the water moves down dip and in the direction of the plunge of the folds to points of discharge into the bays of tidal sloughs. Since hydrostatic heads above sea level exist, some of the water may seep upward and recharge the alluvium. The head in the confined aquifers is high enough at present to maintain the salt water boundary to the west of the edge of the bay, but excessive pumping would allow the boundary to move inland. Within the areas of tidal influence, alluvium is contaminated with salt water.

The Hookton and Carlotta Formations have a high recharge potential. They outcrop over a wide area on three sides of the alluvium, and the geologic structure is favorable for the movement of ground water to the valley area.

a. <u>Storage Capacity</u>. No storage capacity has been estimated for this area. The alluvium is fine-grained, much of it has been contaminated with salt water, and it therefore has a negligible storage capacity. The storage capacity of the Hookton and Carlotta Formations was not estimated due to a lack of data.

b. Pumping Costs. Table 66 shows the estimated total cost of pumping ground water from wells located on the valley floors in the alluviated areas as determined by the procedure outlined on page 50. It is assumed that water would be obtained from the Hookton and Carlotta Formations. The table shows that the cost would be about $9 per acre-foot with a 30 percent use factor. Costs include the drilling of test holes to locate suitable aquifers. There is insufficient information on well characteristics elsewhere in the area to make even rough estimates of the cost. However, the costs will be higher than those on the valley floors because of the greater lift required.

TABLE 66

APPROXIMATE COST OF PUMPING GROUND WATER
IN THE SALMON CREEK-ELK RIVER AREA
OF THE EUREKA PLAINS GROUND WATER BASIN

(In Dollars per Acre-Foot*)

Pumping use factor (percent)	Total annual[1/] cost
10	$20
20	12
30	9
40	7

*Costs include facilities to deliver water at 55 psi at pump discharge.
1/ Based on total lift of 170 feet at 300 gpm.

2. <u>Jacoby Creek-Freshwater Creek Area</u>. The Jacoby Creek-Freshwater Creek area extends northward from the drainage divide between Elk River and Freshwater Creek to the City of Arcata. It borders the eastern edge of Arcata Bay and includes part of the City of Eureka. The area extends inland to the contact with the Wildcat Formation on the east. The topography consists of two alluviated stream valleys, Freshwater Creek and Jacoby Creek, bordered, except on the west, by dissected uplands.

Present ground water development consists of numerous shallow domestic wells and five to ten industrial wells at least 200 feet deep producing from thin, confined sand and gravel aquifers in Hookton and older material. Sanding is a problem with most wells located in the Hookton Formation in this area.

Geologic units in the area include alluvium, terrace deposits, the Hookton Formation, and the undifferentiated Wildcat group. The alluvium underlies the valley floors, and may be up to 50 feet thick. It is commonly very fine-grained, much of it consisting of clay, and yields very small quantities of water to wells. Much of the alluvium has been contaminated with salt water. The terrace deposits occur along the edge of the alluvium. These also yield very little water. The Hookton Formation is the most important source of ground water in this area, although it yields less than 100 gpm to wells up to 370 feet in depth drawing from confined sand and gravel aquifers. The thickness of the Hookton is difficult to determine, since the contact with the underlying Wildcat is not easily identified, but it appears to be up to 460 feet thick. The structure of the area appears to dip to the northwest with minor folds superimposed on this dip. The movement of ground water is probably controlled in part by this regional structure.

Ground water occurs at shallow depths in the alluvium, often less than 5 feet below the ground surface, and fluctuates only a very small amount during the year. Confined aquifers within the Hookton have been found at various depths between 150 and 350 feet, some of which yielded excessively saline water and while others yielded usable fresh water.

Few wells have been drilled in the outcrop area of the Hookton Formation, and the existing wells are essentially all shallow domestic wells. They probably produce from unconfined poorly pervious aquifers. Depths to water in these wells are not known.

The movement of ground water in the area is probably to the north or northwest. Ground water level data are insufficient to enable the construction of ground water contours. Recharge occurs chiefly by rainfall on the outcrop area of the Hookton Formation. Probably very little recharge to the alluvium occurs by stream inflow, as the streambeds are graded on clay.

The recharge potential of the alluvium is very poor, since the upper portion is mostly clay. The Hookton Formation has a moderately good potential for recharge, since the outcrop area is mostly fine sand and can absorb large quantities of water. However, the outcrop area is rather limited in areal extent.

In both alluvial valleys the alluvium is entrenched by tidal sloughs extending up to 2 miles inland, and the greater portion of the alluvium is probably contaminated with salt water at shallow depths. The hydrostatic head in the confined aquifers beneath the alluvium maintains the salt water-fresh water interface to the west of the edge of the bay, but overpumping would allow it to move inland. Careful development is necessary in this area.

a. Storage Capacity. The alluvium has negligible usable storage capacity, since it is fine-grained and contains little water, and much of that has been contaminated with saline water. The storage capacity of the Hookton has not been estimated due to lack of subsurface data.

b. Pumping Costs. Costs to pump ground water for irrigation have been estimated for the areas underlain by alluvium. Since the alluvium has low permeability, the water would be produced from Hookton deposits underlying the alluvium. Costs include the drilling of test holes to locate satisfactory aquifers. Table 67 shows the estimated cost to be $10 per acre-foot with a 30 percent use factor. This cost is based on a well yield of 200 gpm and a pump lift of 150 feet.

Outside the alluviated areas there is insufficient information available to make an accurate estimate of pumping costs. However, the costs would be somewhat higher than in the alluviated areas, since a greater pumping lift would be required. Pumping costs shown in Table 67 were determined by the procedure outlined on page 50.

TABLE 67

APPROXIMATE COST OF PUMPING GROUND WATER
IN THE JACOBY CREEK-FRESHWATER CREEK AREA
OF EUREKA PLAINS GROUND WATER BASIN

(In Dollars per Acre-Foot)

Company use factor (percent)	Cost
10	$24
20	13
30	10
40	8

*Costs include facilities to deliver water at 55 psi at pump discharge.

Mad River Valley. Mad River Valley is the northernmost basin in the Eureka area. It is further divided into six areas: Arcata Plain, Dows Prarie, Little River, Lindsey Creek, Blue Lake, and North Spit.

1. Arcata Plain Area. The Arcata Plain extends from the north end of Arcata Bay to the base of the high terrace north of the Mad River. It includes the ancient flood plain of the Mad River, which in the past emptied into Arcata Bay, and an upland area underlain by the Hookton Formation east and northeast of Arcata. It is bordered on the west by a belt of sand dunes paralleling the coast, and on the east by the contact with the Franciscan Formation. The City of Arcata lies in the southeast portion of the area.

The alluviated portion of the Arcata Plain is 5 miles long and 3-1/2 miles wide, is nearly flat, and has been highly developed for use as pasture land. The western edge of the alluvium is cut by the Mad River Slough, which extends over 3 miles north of the bay. Other tidal sloughs extend inland for shorter distances. The Mad River crosses the north part of the area, and is the only stream of significant size.

Present development of ground water consists of domestic, industrial, and many irrigation wells. Over half the irrigation wells are less than 30 feet deep, as productive sands and gravels are usually found within 50 feet of the surface. The irrigation wells are drilled and cased with 12- to 14-inch casing or dug with a bucket auger and cased with 18- to 36-inch concrete pipe. Most wells have centrifugal pumps, and rotary sprinkler systems are used almost exclusively.

Geologic units in the area include flat-lying alluvium overlying the Hookton Formation, which in turn overlies the Franciscan Formation. The Hookton Formation outcrops and makes up an extensive terrace to the north of the area.

The alluvium is by far the most important source of ground water in the area. It supports wells with yields up to 400 gpm and specific capacities up to 350 gpm per foot of drawdown. The total thickness of the alluvium is probably up to 100 feet in places, but few wells completely penetrate it. Ground water occurs in essentially unconfined conditions from depths of less than 5 feet to over 20 feet. Fluctuations of water levels throughout the year average about 8 feet. Ground water is apparently obtained from interlaced ancient channels of sand and gravel which have good hydraulic continuity with the Mad River to the north. The aquifers are usually surrounded by fine-grained flood plain material, and commonly, the upper 10 feet consists of various combinations of soil, sand, silt, and clay. Some wells fail to encounter aquifers at shallow depth.

The underlying Hookton Formation yields limited quantities of ground water from confined gravelly sand aquifers up to several hundred feet below ground surface. Some of the wells in the Hookton Formation are flowing artesian. The formation is presently being used to provide water for industrial and domestic purposes in the tidal influence area where salt water has contaminated the overlying alluvium, and for domestic purposes in the upland area. The aquifers are only moderately pervious, and are not considered to be a potential source of irrigation supply. Sanding of wells is a problem.

The alluvium is apparently capable of rapid recharge, since the aquifers appear to have good hydraulic continuity with the channel of the Mad River. Rapid infiltration of rainfall into the alluvium is prevented by the fine-grained overlying flood plain deposits. The underlying Hookton Formation probably has a moderately poor recharge potential, depending on the structure in the area. It appears that the recharge area for the portion of the Hookton Formation underlying the alluvium is only the outcrop area east of the alluvium, and that the outcrop area to the north does not contribute to recharge beneath the alluvium. Salt water has intruded the alluvium north of Arcata Bay and east of Mad River Slough, and no shallow wells are located in these zones. There are not enough existing wells to locate the extent of the intrusion. The confined aquifers in the underlying deposits have sufficient head at present to maintain the salt water boundary south of the Arcata Bay shoreline.

a. Storage Capacity. The usable storage capacity has been estimated for the alluviated portion of the Arcata Plain area. That portion of the alluvium which is probably contaminated with salt water has not been included in the estimate. The thickness used is the distance between the estimated average spring water level and sea level. Lowering the water table below sea level would invite further sea-water intrusion. No estimates of storage capacity were made for the deposits lying below sea level.

The following table shows the estimated storage capacity of the alluvium.

TABLE 68

GROUND WATER STORAGE CAPACITY, ARCATA PLAIN

Area (acres)	Saturated thickness (feet)	Estimated average specific yield (percent)	Usable storage capacity (acre-feet)
5,200	15	14	11,000

Lowering the water table to sea level would induce more infiltration from the Mad River and would perhaps result in complete percolation during periods of low flow. If it is assumed that this is undesirable, then the usable storage capacity is limited by the level to which the water table can be lowered without inducing excessive percolation. This quantity will vary with the amount of water available for replenishment.

b. Pumping Costs. The cost to pump ground water for irrigation has been estimated for wells located on the alluviated plain which obtain their water from the alluvium. The cost would be about $5 per acre-foot with a 30 percent use factor. Table 69 shows the cost as related to the use factor for a well pumping 450 gpm through a head of 135 feet, including 55 psi for sprinkler operation, as determined by the procedure outlined on page 50.

Deep, low-capacity wells producing from underlying Hookton deposits are feasible in the tidal influence area and in the upland, outcrop area east of Arcata. Costs have not been computed, but they would probably be too high for the wells to be developed for irrigation.

TABLE 69

APPROXIMATE COST OF PUMPING GROUND WATER IN ARCATA PLAIN AREA OF MAD RIVER VALLEY GROUND WATER BASIN

(In Dollars per Acre-Foot)

Pumping use factor (percent)	Unit annual cost*
10	$8.2
20	5.6
30	4.5
40	3.6

*Costs include facilities required to deliver water at 55 psi at pump discharge.

2. Dows Prarie Area. The Dows Prarie area is located along the coast, and includes the region north of the Mad River and south of Little River. The area is an elevated terrace, ranging in

elevation from 50 feet above sea level on the west to 500 feet on the east. It is bounded on the east by the contact of the Hookton Formation with the Franciscan Formation. The western portion, up to 250 feet in elevation, is relatively flat and rolling. The eastern portion is steeper, more dissected, and consequently less inhabited than the portion on the west. The entire area is drained by three small streams; Mill Creek, tributary to the Mad River, and Widow White Creek and Strawberry Creek, which drain into the ocean.

Present development of ground water is restricted almost entirely to the western portion of the area. The development consists of numerous shallow domestic wells and several low-yielding industrial wells. Practically every house obtains domestic water from wells, since there are no municipal water systems. Total annual ground water pumpage is probably less than 500 acre-feet.

The two geologic units in the area are the Hookton Formation, which is in flat-lying beds and caps the entire area, and the Franciscan Formation, which is nonwater-bearing and underlies the entire area. The Hookton consists of fine sand, silt, clay, and thin gravel beds. Near McKinleyville, the Hookton is at least 150 feet thick, and it may be over 200 feet thick in other places. Wells are up to 150 feet deep and yield up to 175 gpm. Production in the deeper wells is from poorly pervious sandy gravels, and in the shallow wells it is from sands. The average depth of all the wells in the area is about 25 to 30 feet. Sanding is a problem in most of the wells.

In the western portion of the area, ground water occurs in an unconfined condition at depths ranging from ground surface near the creeks to 30 feet below ground surface. Exceptions to this occur near the Arcata County Airport and northward near the edge of the terrace escarpments where water levels are much deeper. Hence, ground water apparently occurs at all depths up to 145 feet. Water levels in the area have been observed to fluctuate 9 to 11 feet during the year. In the eastern portion of the area above elevation 250 feet, ground water occurs at greater depths. One well reportedly did not encounter water closer than 125 feet from ground surface. Little information is available on this portion of the area.

Ground water in the Dows Prarie area moves generally from the east to points of discharge along the base of the cliffs near the ocean. It probably moves across the surface of the bedrock, which acts as an impervious barrier to further downward movement. Recharge occurs essentially only by infiltration of rainfall on the area, since the streams are effluent through most of their routes across the area. Much of the ground surface is underlain by sand which can readily absorb the rainfall, thus providing a moderately good recharge potential. Future development of the area is probably limited to domestic wells and low capacity industrial and irrigation wells because of the moderately low permeability and the problem of sanding in the heavily pumped wells.

a. Storage Capacity. The storage capacity of the western portion of the Dows Prarie area, below 250 feet elevation, has been estimated to a depth of 150 feet. The Hookton Formation is deeper in some places, but there are no well logs available to determine the specific yield or the total depth. The storage capacity of the eastern portion of the area has not been estimated because of lack of information. The thickness of the Hookton Formation is not known, and there is little information regarding depth to water, except that it is greater than in the western part of the area. The following table shows the estimated usable storage capacity of the western portion of the Dows Prarie area by depth intervals

TABLE 70

GROUND WATER STORAGE CAPACITY, DOWS PRARIE

Depth interval (feet)	Thickness (feet)	Surface Area (acres)	Estimated specific yield (percent)	Usable storage capacity (acre-feet)
10-50	40	6,500	12	3,100
50-100	50	6,500	11	3,500
100-150	50	6,500	12	3,900
			Total	10,500

Approximately 9,300 acre-feet of this amount is actually in storage, since the average water level is about 25 feet below the ground surface. No undesirable conditions are expected to result from further ground water development in the area, providing adequat provisions are made for sewage disposal.

b. Pumping Costs. The cost to pump irrigation water has been computed for what is considered to be a typical well for the area. This cost of $9 per acre-foot with a 30 percent use facto applies only to the western portion of the area up to an elevation o 250 feet. Table 71 shows the estimated pumping cost for several use factors. Above 250 feet elevation the pumping costs will be higher because of greater lifts required. Costs were determined by the procedure outlined on page 50.

TABLE 71

APPROXIMATE COST OF PUMPING GROUND WATER IN THE DOWS PRAIRIE SUBAREA OF THE MAD RIVER VALLEY GROUND WATER BASIN

(In Dollars per Acre-Foot)

Pumping use factor (percent)	Unit annual cost*
10	$21
20	12
30	9
40	7

*Costs include facilities to deliver water at 55 psi at pump discharge.

3. Blue Lake Valley Area. Blue Lake Valley is a small alluviated valley 4 miles long and 1-1/2 miles wide, extending along the Mad River 7 air miles upstream from its mouth. The valley appears to be a downfaulted block partially filled with about 100 feet of alluvium deposited by the Mad River and minor tributary streams. Present ground water development includes at least seven irrigation wells, two industrual wells, and an unknown number of domestic wells. The irrigation wells are equipped with centrifugal- and turbine-type pumps, and irrigation is accomplished with rotary sprinkler systems.

Geologic units in and around the valley are, from oldest to youngest, the Franciscan Formation, the Falor Formation of Pliocene age, terrace deposits, and alluvium. The Franciscan Formation is essentially nonwater-bearing. The water-yielding potential of the Falor Formation, which underlies the alluvium, is not well known. It consists of clays, sands, and occasional gravels, and may yield appreciable quantities of water. The water-yielding potential of the terrace deposits on the southwest side of the valley is considered to be negligible.

The alluvium underlies most of the irrigable land in the valley and is the only important aquifer. It is at least 88 feet thick, and consists of flood plain deposits of silt and clay, and river channel deposits of sand and gravel. The existing irrigation wells are located within 3,000 feet of the river, and produce from thick, highly pervious, apparently extensive sand and gravel aquifers in good hydraulic continuity with the Mad River. Wells in the valley range in depth from 14 to 88 feet and yield up to 1,200 gpm with specific capacities up to 100 gpm per foot of drawdown.

Ground water in the alluvium occurs unconfined at depths varying from 5 to 15 feet below ground surface, depending on the location. The average annual fluctuation of ground water levels is about 10 feet.

The alluvium is rapidly recharged by seepage from the small perennial tributary streams and infiltration of rainfall on the valley floor. Limited data indicate that ground water gradients slope toward the river during most of the irrigation season.

Deeper wells and more pumpage would reverse this gradient and induce seepage from the Mad River. With present development the river is probably effluent during most of the year.

a. Storage Capacity. The usable storage capacity has been estimated only for the alluvium in Blue Lake Valley. Little is known about the water-yielding potential of the underlying Falor Formation, and the potential of the terrace deposits is considered to be negligible. The underlying Franciscan is nonwater-bearing.

The alluvium is known to be at least 88 feet thick, and it probably has a maximum thickness of over 100 feet. However, for usable storage computations, an average thickness of 75 feet is used. Few well logs are available for estimating the specific yield of the alluvium, and estimates are partially based on visual examinations in the area. The following table shows the estimated storage capacity by depth zones.

TABLE 72

GROUND WATER STORAGE CAPACITY IN BLUE LAKE VALLEY

Depth zone (feet)	Saturated thickness (feet)	Area (acres)	Estimated average specific yield (percent)	Usable storage capacity (acre-feet)
10-50	40	2,300	25	23,000
50-75	25	2,300	25	14,400
			Total rounded	37,000

Less than 5,000 acre-feet of usable storage is above the elevation of the Mad River, and withdrawals in excess of this amount would result in proportionately increased seepage losses from the river. Lowering the water level in the alluvium below the elevation of the river channel would probably result in excessive percolation, based on the summer river flows.

b. Pumping Costs. The cost to pump ground water from wells in the alluvium is about $4.20 per acre-foot with a 30 percent use factor, as determined by the procedure outlined on page 50. Table 73 shows how the cost varies with use factor.

TABLE 73

APPROXIMATE COST OF PUMPING GROUND WATER IN BLUE LAKE VALLEY SUBAREA OF THE MAD RIVER VALLEY GROUND WATER BASIN

(In Dollars per Acre-Foot)

Pumping use factors (percent)	Unit annual* cost
10	$9.0
20	5.5
30	4.2
40	3.5

*Costs include facilities to deliver water at 55 psi at pump discharge.

4. Little River Valley Area. Little River Valley is an alluviated valley located at the extreme northern end of the Eureka area and extending 1.7 miles inland from the mouth of Little River to the town of Crannell, 9 air miles north of Arcata. The upper or eastern portion of the valley contains about 500 acres of irrigated pastureland underlain by the floodplain of Little River. The lower part of the valley west of Highway 101 is underlain by dune

sand. The valley is surrounded by rocks of the Franciscan Formation, except on the south where the Hookton Formation is in contact with a small portion of the alluvium.

Present development of ground water in the valley consists of several small domestic and stock wells. There are no irrigation wells in the valley, since sufficient water for irrigation is obtained from surface supplies.

The alluvium appears to have a good potential for development of ground water supplies. The valley is filled with an estimated 50 feet of gravelly channel deposits and floodplain material. Shallow wells with yields of up to several hundred gpm could probably be developed in the gravels near the center of the valley.

As Little River is tidal for almost 1 mile inland, the usable storage capacity upstream of the tidal influence area is limited by potential sea-water intrusion. There are no well logs available to estimate specific yield, nor are water levels known, but it is estimated that the usable storage capacity of the alluvium is about 900 acre-feet.

Lindsay Creek Valley Area. The Lindsay Creek Valley includes about 4 square miles of flat alluvium and gently sloping terraces along Lindsay Creek, a tributary to Mad River. The town of Fieldbrook is in the northern end of the valley. The area contains a small amount of pasture, but most of the land is still uncleared or only partially cleared of timber and brush. Present development of ground water is limited to domestic wells which obtain very low yields from thin clayey gravels on the terraces and near Lindsay Creek.

The valley is underlain by Recent alluvium, with terrace deposits on its eastern side. The thicknesses of the deposits are not known. Both are water-bearing, but they are predominantly fine-grained, and the gravels which they contain are poorly productive. Reportedly, attempts have been made to develop irrigation wells, but suitable aquifer material was not encountered. Further development appears to be limited to low-yield domestic wells, and the potential for the development of irrigation supplies from ground water is considered to be negligible.

North Spit Area. The North Spit is a long, narrow barrier of dune sand between Humboldt Bay and the ocean. It extends from the entrance to Humboldt Bay 13 miles northward to the mouth of the Eel River. The maximum width is 4,200 feet, and the average elevation of the ground surface is probably less than 15 feet. The small towns of Samoa and Manila are located on the spit.

Present ground water development consists of low capacity domestic and industrial wells which obtain ground water from a shallow lens of fresh water in the sand. The fresh water apparently floats on the salt water in accordance with the Ghyben-Herzberg principle. Data are not available on the elevation of the underlying salt water surface, but it probably is within 20 feet of the ground surface. One type of well construction successfully used on the spit consists of six 3-inch well points about 7 feet deep spaced around a circle with a radius of 15 feet. They are all connected to a central point and pumped by one centrifugal pump.

Recharge to the area is only by direct infiltration of rainfall. The sand has high permeability, ground water outflow is rapid, and little storage is retained. Future development is limited to shallow, low-yielding wells.

Water Quality

Data on quality characteristics of ground and surface waters in 18 subunits of the Eel River Hydrographic Unit are presented in Table 75. These data characterize surface waters of the hydrographic unit as being generally a soft calcium-bicarbonate type containing low concentrations of total dissolved minerals and boron. Ground waters throughout the unit, while showing only about a twofold increase in mineralization over the general character of companion surface waters, are a generally different mineral type. These ground waters continue to contain low concentrations of total dissolved minerals and boron, while changing in character to a moderately hard calcium-magnesium bicarbonate type. This kind of change in mineral character between surface and ground waters suggests that an ion exchange action, rather than leaching, is predominant in the geochemical processes attributable to the aquifers of this area. In addition, there is a significant occurrence of iron and manganese concentrations in excess of 2 ppm.

While the general character of surface waters in the hydrographic unit represents an excellent mineral quality suitable for all anticipated uses, there are some local as well as potential water quality problems. In the upper reaches of the Eel River watershed, particularly in the Lake Pillsbury, Willis Ridge, and Outlet Creek Subunits, boron often occurs in concentrations that are harmful to many types of crops. Although the median of all reported boron concentrations in these subunits is not high enough to represent an overall problem, the data suggest that some of the small tributary sources may be continuously unusable, while certainly there are periods of time when even the major streams would not be a suitable water supply for general agricultural use. Since the variable occurrence of high boron concentrations appears related to variations in streamflow rate, it follows that water project development in these three subunits will have a profound effect on the quality of waters made available for use. In planning for such future development, close attention must be paid to insuring that the resultant quality of water will be an improvement over the intermittent problems presently occurring. In addition to these observed local water quality problems in the upstream subunits, a potential problem may also exist in the Lower Eel Subunit. Although not observed, it can be inferred by comparison of dissolved mineral concentrations at successive downstream locations that accreting surface waters in this subunit constitute a significant source of water quality degradation. The materialization of this apparent potential problem would be dependent upon future changes in the flow regiment of the lower Eel River. Again there is a need for consideration of this potential water quality problem in the planning of water development projects on the Eel River.

With the exception of some very localized occurrences, ground waters of the inland subunits of the Eel River Hydrographic Unit are of adequate mineral quality suitable for most uses. However, due to the presence of high iron and manganese concentrations, the water would require more than normal treatment for municipal and domestic uses. No additional potential ground water quality problems appear in these subunits. However, while native ground waters in the coastal subunits are of the same mineral quality as inland aquifers, two additional sources of degradation exist as potential ground water quality problems. Sea-water intrusion has been observed to occur along the coastline, and is suspected to be occurring indirectly from the brackish tidal estuaries which extend inland for several miles. In addition, the deeper zones of the coastal aquifers contain water of poor mineral quality. This deep-seated poor quality water is probably of ancient marine origin, rather than the result of recent sea-water intrusion. These two potential water quality problems must be considered as limiting factors in planning for further development of these coastal aquifers

TABLE 74

WATER QUALITY CHARACTERISTICS
EEL RIVER HYDROGRAPHIC UNIT

Hydrographic subunits	Mineral classification	Range of dissolved mineral concentrations		
		Electrical conductivity (micromhos)	Hardness (ppm)	Boron (ppm)
SURFACE WATERS				
Lake Pillsbury	Calcium bicarbonate	95-285	42-133	0.0 -1.5
Willis Ridge	Calcium bicarbonate	88-340	42-136	0.0 -1.1
Outlet Creek	Calcium-magnesium bicarbonate	58-528	24-164	0.0 -9.9
Wilderness	Calcium bicarbonate	198-407	72-141	0.16-0.57
Black Butte River	Calcium bicarbonate	257-320	115-148	0.04-0.25
Etsel	Calcium bicarbonate	91-374	40-152	0.0 -0.7
Round Valley	Calcium-magnesium bicarbonate	129-374	53-174	0.01-0.18
North Fork	Calcium bicarbonate	197-311	91-129	0.19-0.24
Sequoia and Bell Springs	Calcium bicarbonate	101-399	41-204	0.0 -0.3
Laytonville	Calcium-sodium bicarbonate	86-1620	32-249	0.0 -0.16
Lake Benbow and Humboldt Redwoods	Calcium bicarbonate	76-273	28-124	0.0 -0.5
Lower Eel	Calcium bicarbonate	98-804	43-345	0.0 -0.5
Van Duzen River	Calcium bicarbonate	71-319	23-152	0.0 -0.2
Yager Creek	Calcium bicarbonate	282-315	122-137	0.02-0.07
Eureka Plain	Magnesium-sodium bicarbonate	224-538	67-144	0.00-0.37

TABLE 74 (Continued)

WATER QUALITY CHARACTERISTICS
EEL RIVER HYDROGRAPHIC UNIT

Hydrographic subunits	Mineral classification	Range of dissolved mineral concentrations		
		Electrical conductivity (micromhos)	Hardness (ppm)	Boron (ppm)
SURFACE WATERS				
Cape Mendocino	Calcium bicarbonate	72-396	22-162	0.0 -0.5
GROUND WATERS				
Outlet Creek	Calcium-magnesium bicarbonate	110-859	3-330	0.04-3.8
Etsel	Calcium-magnesium bicarbonate	236	113	0.02
Round Valley	Calcium-magnesium bicarbonate	209-691	87-308	0.0 -0.35
Laytonville	Variable	86-1870	23-339	0.04-2.3
Lake Benbow	Calcium-magnesium bicarbonate	81-318	31-141	0.03-0.44
Lower Eel	Magnesium-calcium bicarbonate	132-7200	32-1640	0.0 -0.9
Eureka Plain	Magnesium-calcium bicarbonate	156-869	51-233	0.0 -1.7

MENDOCINO COAST HYDROGRAPHIC UNIT

Surface Water Hydrology

General Description of Unit

The major streams of the Mendocino Coast Hydrographic Unit from north to south are the Ten Mile River, Noyo River, Big River, Navarro River, Garcia River, and Gualala River, all of which are tributary to the Pacific Ocean. These streams are all characterized by deep narrow gorges with a limited amount of bottom land.

As in other parts of California, critical periods of low flow occur during the months of June through October, when there is maximum demand for water for irrigation, recreation, and other uses. Therefore, at present there exists a need to increase low summer flows for the enhancement of fishlife and recreation.

Precipitation

Precipitation in the Mendocino Coast Hydrographic Unit varies from 38 inches annually along the coastline to 70 inches annually in the mountains on the eastern hydrographic unit boundary and 80 inches in areas along the northeastern section of the boundary. The mean annual precipitation for the entire hydrographic unit is approximately 50 inches. More than 97 percent of the total precipitation occurs in an eight-month period beginning in October and ending in May. Rainfall during the other four months of the year averages less than 1 inch per month, with August averaging only 0.01 of an inch. Inland, a substantial portion of the precipitation occurs as snowfall.

Typical Mendocino Coastline

Union Lumber Company at Fort Bragg

Runoff

Mean annual runoff from the Mendocino Coast Hydrographic Unit is about 2,103,600 acre-feet, or approximately 24.7 inches depth, over the 1,599-square-mile area of the unit. Due to the topography and geology of the unit, streamflow is highly responsive to rainfall, and the pattern of runoff follows closely the seasonal distribution of precipitation.

The variation of surface runoff in the Mendocino Coast Unit is well illustrated by streamflow records of the Navarro River gaging station near Navarro. Mean monthly flows at this station are generally 1,720 to 1,920 cubic feet per second during the months of January and February, and about 15 cubic feet per second during August and September. Extremes in flow during the station's 10-year record have varied from 64,500 to 4.7 cubic feet per second, and seasonal yields have ranged from 692,900 to 182,000 acre-feet.

Water Development

Surface water development within the Mendocino Coast Hydrographic Unit controls only a minor portion of the unit's streamflow. There are 108 surface water diversions as determined from diversion data collected in 1958-59 for Bulletin No. 94-10, "Land and Water Use in the Mendocino Coast Hydrographic Unit." Of this total, 75 were used for irrigational purposes. Nearly all of the water diverted in the unit for industry, irrigation, and other purposes during the same period was measured during this investigation, and amounted to some 4,696 acre-feet, or approximately two-tenths of a percent of the estimated mean seasonal runoff. The unit neither imports nor exports water at the present time.

Stream Gaging Stations and Records

All streamflow gaging stations in the Mendocino Coast Hydrographic Unit have relatively short records, the longest records being 13 years. However, since the available records correlate fairly well with nearby long-term precipitation stations, these records are considered adequate to estimate the natural flow of streams within the unit. Table 75 lists all gaging stations within the unit as shown in the department's "Index of Gaging Stations in and Adjacent to California." The location of stations utilized in preparing this report are shown on Plate 1.

TABLE 75

STREAM GAGING STATIONS IN THE
MENDOCINO COAST HYDROGRAPHIC UNIT

USGS station number	DWR reference number	Station	Drainage area in sq. miles	Period of record
	F80100	Ten Mile River, North Fork near Fort Bragg		1953-1953
	F80120	Ten Mile River, Middle Fork near Fort Bragg		1953-1953
	F80140	Ten Mile River, South Fork near Fort Bragg		1953-1953
*11467500	F81100	Gualala River, South Fork near Annapolis	161	1950-date
*11468000	F82100	Navarro River, near Navarro	304	1950-date
11467800	F82500	Rancheria Creek, near Boonville	66	1959-date
*11468500	F83100	Noyo River, near Fort Bragg	105	1951-date
	F84200	Garcia River, near Point Arena		1951-1953
11468070		South Fork Big River, near Comptche	36.3	1960-date
11468010		Albion River, below North Fork near Comptche	14.5	1961-date

*Stations for which unimpaired flows are tabulated in this report.

Streamflow Estimates

Estimates of monthly and annual natural flows for the 50-year period from 1910-11 through 1959-60 were compiled for all gaging stations within the Mendocino Coast Hydrographic Unit for which five or more years of record were available. A brief description of the methods used for individual gaging stations is included with tabulations of streamflow, Tables 77 through 79. Detailed data on correlations used, other correlations attempted, adjustment factors, etc., are available in the files of the North Coastal Area Investigation.

Mean seasonal natural streamflows for the 50-year period from 1910-11 through 1959-60 are summarized in Table 76.

Estimated mean monthly distribution of natural runoff from the Mendocino Coast Hydrographic Unit by subunits is presented in Table 81.

TABLE 76

SUMMARY OF MEAN SEASONAL FULL NATURAL FLOWS IN THE MENDOCINO COAST HYDROGRAPHIC UNIT FOR THE PERIOD FROM 1910-11 THROUGH 1959-60

Subunit and related gaging stations	Mean full natural flow (in acre-feet)
Rockport Subunit	301,900
Fort Bragg Subunit	
Noyo River near Fort Bragg (Gage)	552,500 (144,800)
Navarro Subunit	
Navarro River near Navarro (Gage)	346,600 (337,200)
Point Arena Subunit	279,500
Gualala Subunit	
South Fork Guglala River near Annapolis (Gage)	623,100 (295,000)
Unit Total	2,103,600

TABLE 77

RUNOFF OF SOUTH FORK GUALALA RIVER NEAR ANNAPOLIS

Location: Lat. 38° 42' 10", Long. 123° 25' 00" in NE 1/4 Sec. 21 T10N, R14W, on right bank 1,000 feet downstream from Wheatfield Fork Gualala River and 4.8 miles west of Annapolis.
Drainage area: 161 square miles.
Records available: October 1950 to date.
Recorded extremes: Maximum discharge 55,000 cfs (December 22, 1955); minimum discharge 0.4 cfs (September 13, 1951).
Remarks: Records good. No diversion or regulation. Streamflow at this station is unregulated, so the recorded flows were taken as full natural flows.

Estimates of seasonal natural flows for 1910-11 through 1949-50 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$Y = -132,050 + 10.5259\ X$

Y = seasonal full natural flow, South Fork Gualala River near Annapolis

X = seasonal precipitation (October to September) U. S. Weather Bureau precipitation gage, Fort Ross

$\bar{r}$ = correlation coefficient = 0.9700

$\bar{S}y$ = standard error of estimate = 33,620 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as a base station.

Monthly and seasonal full natural flows at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 77 (CONTINUED)

RUNOFF OF SOUTH FORK GUALALA RIVER NEAR ANNAPOLIS

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F81100
LOCATION LAT 38-42-10N, LONG 123-25-00W
NE1/4 SEC. 21, T10N, R14W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 161 SQ. MILES

AR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
11	1200	4300	12700	93800	61400	91500	58900	17300	7600	1600	700	2000	353000
12	3400	4200	5700	78100	34000	57300	45200	59000	12600	3100	1300	10700	314600
13	2000	30300	34700	109200	33400	21600	35000	10700	3400	1400	800	800	283300
14	700	8300	96000	327500	107600	51900	30100	8100	3500	1200	500	1200	636600
15	3400	2600	17600	130600	260500	90900	68800	51000	15200	3400	1700	1700	647400
16	1300	4000	66700	162000	146300	79200	23500	8000	2800	1400	800	1500	497500
17	1400	3600	24100	31600	121100	47300	58800	17200	4700	1100	800	1500	313200
18	2100	3300	20700	14100	70100	90100	47200	8900	2000	800	800	3100	263200
19	1600	6100	8900	80000	129700	77000	36300	10300	2000	800	500	1400	354600
20	1700	2100	20600	6600	3400	28400	91700	9900	1700	700	300	1000	168100
21	1700	93700	135400	149800	95700	49900	21900	8300	3400	900	400	1200	562300
22	400	2400	14100	11600	63800	31300	32700	12200	3200	1200	600	900	174400
23	5700	11100	66400	51700	27700	11100	39400	5200	2200	900	500	1100	223000
24	2200	4700	2700	10700	25600	3000	2400	1300	500	300	200	400	54000
25	5800	19500	56300	31400	160100	28600	59300	26300	6100	1400	800	1100	396700
26	1600	2600	5600	15900	66000	9500	24100	2900	700	300	200	500	129900
27	1000	35200	47500	82600	133300	32900	38800	7400	1800	600	300	500	381900
28	2100	13200	14400	41800	39000	72100	39400	5400	1200	600	300	500	230000
29	700	9100	26600	16900	33300	13700	14900	5500	2500	1000	500	800	125500
30	300	500	61000	51400	36900	34900	16100	4900	1100	500	300	500	208400
31	500	2300	2300	42400	14200	25900	6300	1600	800	400	300	600	97600
32	1000	4000	66900	42900	17200	16700	10900	7900	1400	400	200	500	170000
33	200	1500	6900	14500	16300	44100	16400	11200	3300	1100	500	800	116800
34	2400	1600	53000	36800	28100	19000	9900	3400	700	400	300	500	156100
35	1400	22900	15200	65900	33100	46200	75400	9800	1800	700	400	600	273400
36	1000	1100	6400	122000	93400	23600	20600	4000	3000	1100	500	700	277400
37	500	1000	2900	4100	59800	80500	64700	15500	4500	1600	800	1100	237000
38	1000	39900	84700	32900	86500	85100	33300	9900	2500	600	400	500	377300
39	5100	9200	37800	29700	30400	43400	11600	4900	1300	600	400	700	175100
40	300	900	18800	97100	137800	69300	27000	5100	1200	500	300	500	358800
41	900	2300	108000	131600	89500	67300	67900	14700	3800	1400	600	900	488900
42	1400	3300	113300	99800	104100	14100	33000	13400	4800	1000	600	800	389600
43	600	14600	54300	137100	36700	32900	19200	6800	2200	800	400	600	306200
44	600	2800	7100	38700	41400	74000	26500	13300	3900	1500	800	1100	211700
45	1100	29900	51100	24500	78100	36300	27700	8000	2500	900	500	700	261300
46	6300	31600	159600	69800	22100	19500	14900	3800	900	400	200	400	329500
47	200	14200	18500	3500	29900	45400	14200	2000	2000	700	400	600	131600
48	16700	6100	6200	81400	17600	40900	112800	27400	7400	1700	800	1800	320800
49	1700	5700	18300	15800	43400	99700	36900	9400	1800	700	500	800	234700
50	300	2800	2900	67200	63300	47900	34300	9100	2200	800	500	700	232000
951	11700	24400	82600	87300	71100	45900	5900	9700	1700	800	200	100	341400
952	1300	18600	144100	129800	65600	55700	9900	5500	2200	1000	400	200	434300
953	200	1000	113600	153800	7500	29600	21500	10000	3200	1200	500	400	342500
954	900	20400	16600	133100	48000	51800	58500	6700	2400	900	1500	600	341400
955	900	22300	48100	36200	8200	5100	39200	8300	2000	800	300	200	171600
956	400	5200	188100	145500	94900	16800	6000	4800	1600	700	300	300	464600
957	2300	1400	900	29700	57700	58000	18400	40500	6100	1500	600	5300	222400
958	45300	13400	35500	81300	244800	53500	74800	6000	3600	1200	600	300	560300
959	400	1200	1400	69700	85100	10100	5200	2000	800	300	200	2100	178500
960	700	500	800	31300	98500	73100	11200	4800	1900	800	400	300	224300
OTAL	147600	566900	2203600	3552700	3473200	2253600	1698600	559300	155700	49700	26700	57100	14744700
EAN	3000	11300	44100	71000	69500	45100	34000	11200	3100	1000	500	1100	294900
ERCENT	1.0	3.8	15.0	24.0	23.6	15.3	11.5	3.8	1.1	0.3	0.2	0.4	100.0

TABLE 78

RUNOFF OF NAVARRO RIVER NEAR NAVARRO

Location: Lat. 39° 10' 15", Long. 123° 39' 55" in Se 1/4 Sec. 7 T15N, R16W, on left bank 2.7 miles downstream from North Fork, 5.4 miles upstream from mouth and 6.6 miles west of Navarro.
Drainage area: 304 square miles.
Records available: October 1950 to date.
Recorded extremes: Maximum discharge 64,500 cfs (December 22, 1955); minimum discharge 4.7 cfs (August 26, 27, 1959).
Remarks: Records good except those for period of no gage-height record, which are poor. No regulation or diversion. Streamflow at this station is unregulated so the recorded flows were taken as full natural flows.

Estimates of seasonal natural flows for 1910-11 through 1949-50 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$\text{Log } Y = \text{Log } 280 + 1.9412 \text{ Log } X$$

Y = seasonal full natural flow, Navarro River near Navarro

X = seasonal precipitation (October to September) U. S. Weather Bureau precipitation gage, Fort Bragg

$\bar{r}$ = correlation coefficient = 0.9404

$\bar{S}y$ = standard error of estimate = 72,090 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage Eel River at Van Arsdale Dam near Potter Valley was used as a base station.

Monthly and seasonal full natural flows at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 78 (CONTINUED)

RUNOFF OF NAVARRO RIVER NEAR NAVARRO

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F82100
LOCATION LAT 39-10-15N, LONG 123-39-25W
SE1/4 SEC. 7, T15N, R16W MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 304 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
11	600	2200	7400	64600	45000	70400	37000	11000	6400	1700	800	900	248000
12	2400	3200	5000	80700	37300	66100	42600	56500	16000	4800	2200	7000	323800
13	1200	19400	25700	95900	31200	21200	28000	8700	3700	1800	1100	400	238300
14	500	6000	79500	321600	112300	57000	27000	7400	4200	1700	800	700	618700
15	2500	2000	15400	136300	289000	105900	65500	49200	19500	5400	2800	1100	694600
16	700	2100	40800	117600	112900	64200	15500	5400	2500	1600	900	700	364900
17	700	1900	14700	22800	93100	38200	38800	11500	4100	1200	1000	700	228700
18	700	1200	8700	7000	37000	50100	21400	4100	1200	600	600	1000	133600
19	1100	4600	7800	82700	142600	89000	34200	9900	2600	1200	900	900	377500
20	800	1000	11100	4200	2300	20300	53500	5900	1400	600	300	400	101800
21	1300	74300	124200	162900	110700	60700	21800	8300	4600	1500	800	800	571900
22	300	2100	14100	13700	80300	41300	35300	13400	4600	2100	1100	700	209000
23	4400	8900	61200	56500	32200	13500	39300	5300	3000	1400	800	800	227300
24	1900	4200	2800	13100	33400	4100	2700	1500	700	500	400	300	65600
25	5900	20300	67800	44800	243000	45600	77100	34800	10700	2900	1800	1000	555700
26	1600	2700	6700	22400	99000	15000	31000	3700	1200	600	400	400	184700
27	1000	34500	53800	110800	190200	49400	47500	9200	3000	1200	600	400	501600
28	2000	12600	15900	54600	54200	105100	46900	6500	2000	1100	700	400	302000
29	800	11100	37300	27900	58700	25400	22500	8400	5100	2400	1400	800	201800
30	100	300	41700	41600	31800	31600	11900	3700	1100	600	300	300	165000
31	300	1600	1800	39600	14100	26900	5400	1400	900	600	400	300	93300
32	900	3900	76300	58000	24800	25200	13400	9900	2300	800	500	400	216400
33	300	2200	11700	29400	35000	99600	30200	20900	8100	3200	1700	1000	243300
34	1800	1300	47100	38800	31500	22400	9500	3300	900	600	400	300	157900
35	1300	22300	17200	87800	46900	68900	91700	12100	2900	1300	900	500	353800
36	900	1000	6700	150800	122700	32500	23200	4600	4600	2000	900	600	350500
37	300	700	2500	4200	65300	92400	60600	14700	5700	2400	1400	700	250900
38	1300	50400	123900	57100	159500	165000	52600	16000	5400	1600	1000	500	634300
39	3300	6100	28800	26800	29200	43600	9500	4000	1400	800	600	400	154500
40	200	600	16500	100900	152300	80500	25600	4900	1600	700	500	300	384600
41	1100	2800	153500	221600	160300	126600	104300	22900	7900	3400	1500	900	806800
42	1500	3700	145200	151600	168100	23900	45800	18800	8900	2300	1500	800	572100
43	500	12400	53300	159800	45400	42800	20400	7400	3100	1400	800	500	347800
44	300	1800	5200	33700	38400	72100	21100	10800	4200	1900	1100	600	191200
45	1000	28400	56200	31900	108200	52800	32900	9600	3900	1800	1100	600	328400
46	7000	36000	210400	109000	36700	34000	21200	5600	1600	900	600	400	463400
47	100	10600	15900	3600	32500	51800	13200	1900	2500	1100	700	400	134300
48	12800	4800	5700	88700	20400	49700	112000	27600	9900	2800	1400	1200	337000
49	1400	4900	18100	18600	54200	130800	39500	10200	2600	1300	900	600	283100
50	200	1800	2200	60700	60900	48300	28300	7600	2400	1100	700	400	214600
51	16000	30900	96100	141500	84700	54300	8600	10900	2800	1400	800	500	448500
52	1300	12000	162100	170700	93500	77200	13300	6100	3200	1800	800	700	542700
53	600	1900	96800	231200	16500	45500	19800	13200	6500	2200	1400	1000	436600
54	1400	13600	13900	123200	89300	64500	55000	7500	4000	1800	1400	1200	376800
55	1500	14900	45600	47200	12400	8900	31800	14200	2700	1400	800	600	182000
56	800	3200	235800	211300	141900	36600	8200	4400	2300	1300	800	600	647200
57	2200	2500	1900	25700	64400	77900	17600	28700	6200	2000	1000	1900	232000
58	22600	14300	42200	104100	306700	77200	108300	8800	4500	2100	1200	900	692900
59	1000	2700	3000	83900	106500	16700	9300	3200	1600	800	400	1000	230100
60	900	900	1600	18300	114200	76800	13800	7600	3300	1500	800	400	240100
TOTAL	115300	508800	2338800	4111400	4272700	2799500	1745600	583200	215500	83200	47700	39900	16861600
MEAN	2300	10200	46800	82200	85300	56000	34900	11700	4300	1700	1000	800	337200
PERCENT	0.7	3.0	13.9	24.4	25.3	16.6	10.3	3.5	1.3	0.5	0.3	0.2	100.0

TABLE 79

RUNOFF OF NOYO RIVER NEAR FORT BRAGG

Location: Lat. 39° 26', Long. 123° 44' in SW 1/4 Sec. 10 T16N, R17W, on right bank 0.7 miles downstream from South Fork and 3.5 miles east of Fort Bragg.
Drainage area: 105 square miles.
Records available: August 1951 to date.
Recorded extremes: Maximum discharge 22,000 cfs (December 22, 1955); minimum discharge 2.4 cfs several days in August and September 1959.
Remarks: Records good. No regulation or diversion. Streamflow at this station is unregulated so the recorded flows were taken as full natural flows.

Estimates of seasonal natural flows for 1910-11 through 1950-51 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$\text{Log } Y = \text{Log } 90 + 2.0051 \text{ Log } X$$

Y = seasonal full natural flow, Noyo River near Fort Bragg

X = seasonal precipitation (October to September) U. S. Weather Bureau precipitation gage, Fort Bragg

$\bar{r}$ = correlation coefficient 0.9534

$\bar{S}y$ = standard error of estimate = 25,080 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage Eel River at Van Arsdale Dam near Potter Valley was used as a base station.

Monthly and seasonal full natural flow at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 79 (CONTINUED)

RUNOFF OF NOYO RIVER NEAR FORT BRAGG

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F83100
LOCATION LAT 39-26N, LONG 123-44W
SW1/4 SEC. 10, T18N, R17W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 105 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	300	1100	3500	27500	16000	30500	15600	5300	3500	900	400	400	105000
1912	1200	1500	2300	33500	13000	27800	17400	26500	8400	2600	1100	3100	138400
1913	600	9400	11800	39800	10900	9000	11500	4100	1900	1000	600	200	100800
1914	200	3100	38600	141700	41500	25500	11700	3700	2400	1000	400	300	270100
1915	1300	1000	7800	62400	110800	49300	29600	25500	11300	3200	1600	600	304400
1916	300	1100	19900	52000	41800	28800	6800	2700	1400	900	500	300	156500
1917	300	1000	7100	10100	34500	17100	16900	5800	2300	700	500	300	96600
1918	300	600	4100	3000	13200	21600	9000	2000	700	300	300	400	55500
1919	600	2400	3900	37300	53900	40800	15200	5000	1500	700	500	400	162200
1920	400	400	4900	1700	800	8300	21200	2700	700	300	200	200	41800
1921	600	37000	58500	69600	39700	26300	9200	4000	2500	800	400	400	249000
1922	200	1000	6800	6000	29300	18300	15100	6600	2600	1200	600	300	88000
1923	2100	4300	27900	23400	11100	5700	16000	2500	1600	700	400	300	96000
1924	900	2100	1300	5600	12000	1800	1100	700	400	300	200	100	26500
1925	3000	10700	33700	20200	92000	20900	34300	17700	6100	1700	1000	500	241800
1926	800	1400	3400	10200	37600	6900	13800	1900	700	400	200	200	77500
1927	500	18000	26600	49700	71600	22500	21000	4600	1700	700	400	200	217500
1928	1000	6300	7500	23400	19500	45900	19800	3100	1100	600	400	200	128800
1929	400	5400	17300	11800	20700	10900	9300	4000	2700	1300	700	400	84900
1930	100	100	19100	17400	11100	13400	4900	1700	600	300	200	100	69000
1931	200	800	800	16300	4900	11200	2200	600	500	300	200	200	38200
1932	400	1800	34300	23700	8500	10400	5400	4500	1200	500	300	200	91200
1933	100	1100	5400	12300	12300	42200	12400	9900	4300	1700	900	400	103000
1934	800	600	21600	16100	10900	9400	3900	1500	500	300	200	100	65900
1935	600	11100	8100	37600	16800	30000	38600	5800	1600	700	500	200	151600
1936	500	500	3300	67700	46200	14800	10300	2300	2600	1200	500	300	150200
1937	200	400	1200	1800	23700	40600	25800	7200	3100	1300	700	300	106300
1938	600	25600	59500	24900	58300	73000	22600	7900	3000	900	600	200	277100
1939	1500	2900	13100	11000	10100	18300	3900	1900	800	400	300	200	64400
1940	100	300	8300	45800	58000	37100	11500	2500	900	400	300	100	165300
1941	500	1500	74800	98000	59400	56800	45400	11400	4400	1900	800	400	355300
1942	800	1900	70400	66700	62000	10700	19800	9300	5000	1300	800	400	249100
1943	200	6100	25000	67900	16200	18500	8500	3500	1700	800	400	200	149000
1944	200	900	2400	14200	13600	31000	8800	5100	2200	1000	600	300	80300
1945	500	14300	26700	13800	39200	23200	14000	4700	2100	1000	600	300	140400
1946	3200	17200	95400	44800	12600	14200	8600	2600	800	500	300	200	200400
1947	100	5100	7300	1500	11300	21800	5400	900	1300	600	300	100	55700
1948	6100	2400	2600	37200	7200	21200	46300	13100	5300	1500	700	600	144200
1949	700	2400	8500	8000	19500	56900	16600	4900	1400	700	500	300	120400
1950	100	900	1100	26500	22200	21400	12100	3700	1300	600	400	200	90500
1951	8600	14300	47500	47700	27000	13000	4000	4000	1200	500	300	200	168300
1952	1000	5600	81800	63600	47900	25600	5700	3300	1800	1000	500	400	238200
1953	400	1400	49400	116200	8200	26000	10000	9500	6000	2000	1100	700	230900
1954	900	8200	12300	72900	28000	22600	22600	3400	2100	1100	800	600	175500
1955	700	5000	16300	22600	4700	4400	10800	4600	1400	800	400	300	72000
1956	500	3600	94200	84500	45000	16100	3600	2300	1200	600	400	300	252300
1957	1200	1300	1100	7500	17700	43300	9400	17000	3200	1200	600	700	104200
1958	6400	10200	26500	40600	117400	33800	44200	3800	2200	1100	500	400	287100
1959	400	1100	1400	37700	34900	7200	5000	1600	800	400	200	400	91100
1960	300	300	700	6300	47200	40200	7700	4200	1900	700	400	300	110200
TOTAL	52900	256700	1107000	1781700	1571900	1226200	744500	287100	119900	46600	25700	18400	7238600
MEAN	1100	5100	22100	35800	31400	24500	14900	5700	2400	900	500	400	144800
PERCENT	0.8	3.5	15.3	24.7	21.7	16.9	10.3	3.9	1.7	0.6	0.3	0.3	100.0

TABLE 80

ESTIMATED MEAN MONTHLY DISTRIBUTION OF NATURAL RUNOFF
FROM MENDOCINO COAST HYDROGRAPHIC UNIT

50-YEAR MEAN PERIOD, 1910-60

Subunits and related gaging stations		October		November		December		January		February		March		April		May		June		July		August		September		Total
Ref. No.	Name	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Acre-feet
F-8A	Rockport	0.8	2,400	3.5	10,600	15.3	46,200	24.6	74,300	21.7	65,500	16.9	51,000	10.3	31,100	3.9	11,800	1.7	5,100	0.6	1,800	0.4	1,200	0.3	900	301,900
F-8B	Fort Bragg	0.8	4,400	3.5	19,300	15.3	84,500	24.6	135,900	21.7	119,900	16.9	93,500	10.3	56,900	3.9	21,500	1.7	9,400	0.6	3,300	0.4	2,200	0.3	1,700	552,500
F-8 3100	Noyo River near Fort Bragg	0.8	1,100	3.5	5,100	15.3	22,200	24.7	35,700	21.7	31,400	16.9	24,500	10.3	14,900	3.9	5,700	1.7	2,400	0.6	900	0.3	500	0.3	400	144,800
F-8C	Navarro River	0.7	2,400	3.0	10,400	13.9	48,200	24.4	84,600	25.3	87,700	16.6	57,500	10.4	36,100	3.4	11,800	1.3	4,500	0.5	1,700	0.3	1,000	0.2	700	346,600
F-8 2100	Navarro River near Navarro	0.7	2,300	3.0	10,200	13.0	46,800	24.4	82,200	25.3	85,400	16.6	56,000	10.4	34,900	3.4	11,600	1.3	4,300	0.5	1,700	0.3	1,000	0.2	800	337,200
F-8D	Point Arena	0.8	2,200	3.4	9,500	14.4	40,200	24.3	67,900	24.5	68,500	16.0	44,700	10.9	30,500	3.6	10,100	1.2	3,400	0.4	1,100	0.2	600	0.3	800	279,500
F-8E	Gualala	1.0	6,200	3.8	23,700	14.9	92,800	24.1	150,200	23.6	147,100	15.3	95,300	11.5	71,600	3.8	23,700	1.1	6,900	0.3	1,900	0.2	1,200	0.4	2,500	623,100
F-8 1100	South Fork Gualala River near Annapolis	1.0	3,000	3.8	11,300	14.9	44,100	24.1	71,100	23.6	69,500	15.3	45,100	11.5	34,000	3.8	11,200	1.1	3,100	0.3	1,000	0.2	500	0.4	1,100	295,000
	Total: Mendocino Coast Hydrographic Unit		17,600		73,500		311,900		512,900		488,700		342,000		226,200		78,900		29,300		9,800		6,200		6,600	2,103,600

Ground Water Hydrology

Rockport Subunit

This area includes the drainage of Ten Mile River and some minor drainages to the north, such as Wages, Dehaven, Cotteneva, and Usal Creeks. It is located in northwestern Mendocino County, and contains the towns of Rockport and Westport.

Geologic Conditions. Nonwater-bearing sandstone and shale bedrock of Cretaceous-Jurassic age underlie approximately 97 percent of the drainage area. The remaining 3 percent is underlain by water-bearing deposits, of which about 2 percent is alluvium in the drowned river valleys, and 1 percent is marine terrace deposits. The alluvium in the valleys is about 500 to 1,000 feet wide at the mouth of the streams and may be in excess of 100 feet deep at the center. The marine terraces lie between 50 and 250 feet in elevation, are generally less than one-half mile wide, and directly overlie nonwater-bearing rocks.

Occurrence and Nature of Ground Water. The consolidated sandstone and shale bedrock is considered to be nonwater-bearing, although scattered springs and wells in these rocks supply minor quantities of water for domestic and stockwatering purposes. Ground water reservoir capacity of the water-bearing units was estimated, since no well log data were available. The marine terrace deposits underlie an area of approximately 1,200 acres, and assuming an average saturated thickness of 25 feet and an average specific yield of 9 percent, an estimated ground water storage capacity of 2,500 acre-feet is obtained for these deposits. The alluvial materials underlie about 2,300 acres. Assuming an average thickness of 40 feet above sea level and an average specific yield of 12 percent, the alluvium would contain about 11,000 acre-feet of usable capacity. The total usable ground water storage capacity above sea level in the Rockport Subunit therefore is estimated to be 13,500 acre-feet. Usable storage capacity for this subunit is shown on Table 81.

The alluvial materials in the drowned river valleys along the coast are in direct contact with the ocean; sea-water intrusion may occur if ground water levels are lowered below sea level. Ten Mile River has an extensive tidal reach, indicating that intrusion is possible here if ground water levels are lowered.

Recharge to the terrace deposits is by infiltration and percolation of precipitation and surface runoff from small streams, and possibly by some subsurface inflow through fissures in the bedrock. Most of the long narrow alluviated valleys have perennial streams in them which provide year-round recharge. Ground water is principally unconfined in the water-bearing deposits, although some confinement may occur near the mouths of the coastal streams. Movement of water in the terraces is generally westward in the direction of topographic slope toward the ocean. Movement in the valleys is probably in the general direction of topographic slope.

Fort Bragg Subunit

This area includes all the drainage between the Ten Mile River and the Navarro River in Mendocino County. The largest of

TABLE 81

USABLE GROUND WATER STORAGE CAPACITY
MENDOCINO COAST HYDROGRAPHIC UNIT

Ground water area	Water-bearing unit	Average specific yield (percent)	Depth zone (feet)	Area (acres)	Usable storage capacity (acre-feet)
Rockport Subunit	Alluvium	12	10-50	2,300	11,000
	Terrace deposits	9	5-30	1,200	2,500
Fort Bragg Subunit	Alluvium	12	10-50	4,100	20,000
	Terrace deposits	11	5-40	20,000	75,000
Navarro Subunit	Alluvium and Terrace deposits	5.5	10-160	5,700	47,000
Point Arena Subunit	Alluvium and Terrace deposits	12	5-30	17,000	51,000
Gualala Subunit	Alluvium	12	10-50	2,000	9,500
	Terrace deposits	9	5-15	1,200	1,000
				Total	217,000

these drainages are the Noyo, Big, and Albion Rivers, and Pudding, Hare, Casper, and Big Salmon Creeks. The principal ground water basin is the Fort Bragg terrace. The principal towns are Fort Bragg, Noyo, Caspar, Mendocino, Little River, and Albion.

Geologic Conditions. The area is underlain principally by consolidated sandstone and shale of the Franciscan Formation. Pleistocene marine terraces extend several miles inland and reach elevations of over 500 feet. They range in thickness from a few inches to over 100 feet. Elevation changes along active faults may have caused increased sedimentation resulting in increased extent and thickness of the terraces in this area. The mouths of many of the river valleys are filled with alluvium probably deposited when the level of the sea rose at the end of the last ice age. In an area north of Fort Bragg there are some active sand dunes. Many signs of faulting and shearing are seen in the area, but no faults were mapped.

Occurrence and Nature of Ground Water. About 8 percent of this area is underlain by water-bearing sediments. The water-bearing units are the marine terrace deposits, the river alluvium, and the sand dunes. For this investigation about 40 well logs were located in the Fort Bragg Subunit, and 26 of these wells were field checked.

The terrace deposits are the most extensive water-bearing units in the subunit. They cover an area of about 20,000 acres. The estimated average saturated thickness is 35 feet and the specific yield is about 11 percent. From these values the usable ground water storage capacity of these terraces is estimated to be about 75,000 acre-feet. Ground water is probably unconfined and recharged by infiltration of rainfall and surface runoff. It moves downslope through the terraces toward the ocean and toward the streams which dissect the area. In the spring the water table is high, within inches of the land surface in some places. Shallow dug wells in the terraces are the main source of domestic water outside the Fort Bragg city limits. These wells are 10 to 30 feet deep and many are nearly dry by October or November. No tests of the yields of the dug wells were available. Drilled wells up to 200 feet in depth have been constructed in the same area. Their yield is generally below 30 gpm and their specific capacity about one gallon per minute per foot of drawdown. These wells usually penetrate the terraces and extend into the underlying bedrock; a few extend below sea level.

The alluvium covers an area of approximately 4,100 acres. For an average thickness of about 40 feet above sea level and a specific yield of about 12 percent, the estimated usable ground water reservoir storage of the alluvial valleys is 20,000 acre-feet. No logs of wells in the alluvium could be located. The alluvium is in contact with the ocean, and tidal reaches occur in some of the valleys. In many streams the alluvial deposits extend below sea level. Ground water is probably unconfined, and moves in the direction of surface slope. Extensive development of ground water in the alluvium would be limited by possible intrusion of sea water in the coastal portion of valleys. There is little or no present development because of availability of surface water.

The sand dunes cover an area of 1,500 acres and are estimated to have an average depth of 50 feet. However, due to topography, high permeability, and contact with the ocean on the northwest side, it is thought that the storage capacity is not usable, and it has therefore been left out of the subunit total.

Total usable ground water reservoir capacity above sea level is estimated to be 95,000 acre-feet in the Fort Bragg Subunit. Usable ground water storage capacity for this subunit is shown on Table 81.

Navarro Subunit

This area consists mainly of the drainages of the Navarro River and its tributary, Rancheria Creek. The principal ground water basin is Anderson Valley. The towns are Yorkville, Boonville, Philo, and Navarro.

Geologic Conditions. Consolidated nonwater-bearing sandstone and shale of the Franciscan Formation underlie about 97 percent of the drainage area. The remaining 3 percent is water-bearing fluviatile and lacustrine sediments in Anderson Valley and in several smaller areas. These latter deposits have been mapped as three units according to their age. They are the alluvium presently being deposited in stream channels and flood plains, the sediments in dissected stream terraces, and older dissected stream terrace deposits which show considerable deformation, consolidation, and cementation. In this report, these units are combined. Faulting appears to have played an important part in the formation of Anderson Valley, but none of the existing geologic mapping shows faulting in the water-bearing units.

Occurrence and Nature of Ground Water. The most extensively developed ground water basin in the Navarro Subunit is Anderson Valley. Ground water appears to be unconfined except for a small pressure area around Boonville. Recharge is probably by direct infiltration of rainfall and streamflow. Movement is probably northwestward along the valley axis. A major portion of the valley's irrigation and domestic requirements are supplied from ground water.

During this investigation about 40 well logs were located in this area. Drillers' reports indicated yields were commonly 20 to 30 gpm with specific capacities of a fraction of a gallon per minute per foot of drawdown, although some yields up to 300 gpm have been reported.

Logs of some of the deeper wells indicated an average specific yield of about 4 percent. Depth of sediments varied from less than 100 feet around Philo to in excess of 350 feet at one well near Boonville. The ground water reservoir includes 5,700 acres with an estimated average usable saturated thickness of 150 feet and an average specific yield of 5.5 percent, giving a capacity of 47,000 acre-feet.

Point Arena Subunit

The subunit includes all of the drainage south of the Navarro River and north of the Gualala River. The main ground water basin is the Point Arena Terrace area. Major streams include the Garcia River and Greenwood, Elk, and Alder Creeks. The towns of Point Arena, Manchester, and Elk are located in the area.

Geologic Conditions. The bedrock in this subunit is divided by the San Andreas fault. On the east side of the fault, sandstone, shale, greenstone, and metamorphic rocks of the Franciscan Formation are present. On the west side, marine formations of Cretaceous and Tertiary age and Tertiary volcanic rocks occur. The water-bearing units are the alluvium and marine terraces overlying the bedrock. Sand dunes also are present, but probably do not retain water long enough to have useful reservoir capacity.

Occurrence and Nature of Ground Water. The alluvium and marine terrace deposits make up about 10 percent of the watershed area. Ground water is not developed extensively. It probably occurs in unconfined, discontinuous aquifers and moves in a general westward direction in accordance with the prevailing topographic slope. Recharge probably occurs from direct infiltration of rainfall and streamflow. The few drillers logs from previous investigations were not adequate for a good estimate of thickness, yields, and storage. The following estimate of ground water storage capacity is based on the meager data available and on similarity to the Fort Bragg area. The sediments occupy an area of about 17,000 acres and have an estimated average saturated thickness of 25 feet and an average specific yield of 12 percent. The estimated usable ground water reservoir capacity is thus about 51,000 acre-feet, as indicated on Table 81.

Gualala Subunit

This area lies in southern Mendocino and northern Sonoma Counties. The Gualala River drains most of the watershed and is the only major stream. The largest settlement is Gualala at the mouth of the river.

Geologic Conditions. Consolidated, nonwater-bearing marine sandstone and shale are the main bedrock types. West of the San Andreas fault the Gualala Formation occurs, and east of the fault the Franciscan Formation is present. The water-bearing units are alluvium, located principally along the Gualala River, marine terrace deposits on the coast, and the marine Ohlson Ranch Formation.

Occurrence and Nature of Ground Water. Water-bearing units cover about 4-1/2 percent of the watershed area. Although ground water is not extensively developed, some domestic and stockwater is derived from this source. A brief reconnaissance was made of the area, and two well logs were located. No ground water quality data were available.

Marine terrace deposits and alluvium are the principal water-bearing units in this area. The older Ohlson Ranch Formation exposed in the uplands is considered to be water-bearing in local areas. Marine terrace deposits along the coast are of small areal extent and are thin. They cover about 1,200 acres and are assumed to have a saturated thickness of 10 feet. Assuming a 9 percent specific yield gives a storage capacity of 1,100 acre-feet. The alluvium covers 2,000 acres, has a thickness of about 40 feet, a specific yield of about 12 percent, and a usable storage capacity of 9,500 acre-feet. The third unit considered water-bearing is the Ohlson Ranch Formation. This is a discontinuous deposit of semi-consolidated, slightly deformed marine sandstone of Pliocene age. It occurs as remnants of a shallow water deposit 500 to 1,700 feet above sea level, and is presently distributed along the tops of hills and ridges in the drainage area. It is similar in age and mode of deposition to the Merced Formation to the south. Because of its topographic position and discontinuous areal extent, and because all yields would probably be very low, storage capacity in the Ohlson Ranch Formation will not be considered usable. Total usable ground water storage capacity in the alluvium and marine terraces of Gualala River Subunit is about 10,500 acre-feet as shown in Table 81.

Water Quality

Mineral quality characteristics of surface and ground waters in the Mendocino Coast Hydrographic Unit are presented in Table 82. The general mineral character of surface waters is a soft, calcium-magnesium bicarbonate type, low in total dissolved minerals and boron. Ground waters in the hydrographic unit exhibit an unusual mineral character in that they are almost identical to surface waters in their total dissolved mineral concentrations, but differ in both cation and anion type. These ground waters are usually much softer than surface waters and are generally a sodium bicarbonate-chloride type. This unusual difference between the mineral character of ground and surface waters probably results from the fact that direct percolation of precipitation is an important source of recharge to these shallow coastal aquifers. In this coastal area, precipitation often possesses a highly dilute sea-water characteristic, which is directly reflected by the mineral character of the ground waters.

There appear to be no significant existing or potential water quality problems in either ground or surface sources. All sources are in general of an excellent mineral quality suitable for most beneficial uses. However, the occurrence of iron compounds in the ground water may, in some areas, require special treatment of the water for domestic and municipal uses.

TABLE 82

WATER QUALITY CHARACTERISTICS
MENDOCINO COAST HYDROGRAPHIC UNIT

Hydrographic subunits	Mineral classification	Range of dissolved mineral concentrations		
		Electrical conductivity (micromhos)	Hardness (ppm)	Boron (ppm)
SURFACE WATERS				
Rockport	Calcium bicarbonate	141	53	0.30
Fort Bragg	Calcium bicarbonate	120-215	46-85	0.00-0.40
Navarro River	Calcium-magnesium bicarbonate	201-263	90-109	0.10-0.20
Point Arena	Calcium-magnesium bicarbonate	164-179	55-61	0.00-0.49
Gualala River	Calcium-magnesium bicarbonate	222-274	102-116	0.10-0.20
GROUND WATER				
Rockport	Calcium-sodium bicarbonate	487	142	0.77
Fort Bragg	Sodium-bicarbonate-chloride	109-1010	22-255	0.01-0.77
Navarro River	Sodium-magnesium bicarbonate	100-612	19-199	0.03-4.5
Point Arena	Sodium chloride-bicarbonate	101-693	7-102	0.04-0.13

RUSSIAN RIVER HYDROGRAPHIC UNIT

Surface Water Hydrology

General Description of Unit

The Russian River Hydrographic Unit is drained primarily by the Russian River and its tributaries. The Russian River from its source in the inner Coast Range, follows a generally southern course, winding through the farm lands of the valleys between the mountains of the Coast Range. At Mirabel Park the river turns and flows westward the last third of its length to the Pacific Ocean at Jenner.

The most serious water problem in the unit is the periodic occurrence of damaging floods. Records indicate that the Russian River ant its major tributaries flood, on the average, about every two or three years. In the past 20 years, major floods have occurred in February 1940, January 1943, December 1950, December 1951, January 1954, February 1956, February 1958, and February 1960. A comparison of present watershed conditions with descriptions of early conditions indicates that flood problems have been aggravated by depletion of watershed cover as a result of cultivation, overgrazing, clearing, and repeated burning. Flood water and sediment damages are increasing yearly with more intensive development of agricultural, industrial, and urban use throughout the watershed. This problem has been alleviated somewhat by the construction of channel stabilization works and Coyote Reservoir, a 122,500 acre-foot multiple-purpose reservoir on the East Fork of the Russian

River. Authorization has also been given for the construction of Warm Springs Reservoir, a multiple-purpose reservoir of 277,000 acre-feet capacity on Dry Creek near Cloverdale.

As in other parts of California, critical periods of low flow occur during the months of June through October when there is maximum demand for water for irrigation, recreation, and other uses. Prior to construction of Coyote Reservoir, discharge in the lower reaches of the river was often less than 100 second-feet at Guerneville during late summer and fall months. Minimum runoff usually occurs during July and August. There is a minor increase in flow during September and October due in part to a decrease in the diversion of water for irrigation use. Irrigation diversions which decrease the low summer flows were considered highly significant, and an attempt was made to adjust for their effect in this report.

Precipitation

Precipitation in the Russian River Hydrographic Unit averages about 44 inches annually, occurring principally as rainfall. The rainy season extends from October through May. June has a slight amount of rainfall, less than 1 inch, while July, August, and September are virtually dry. The wettest months are December and January, with December rainfall averaging over 8 inches. Rainfall distribution in the valley area varies from 40 inches in the main part to a low of 30 inches in the extreme southern portion. With increase in elevation, the precipitation increases and averages 50 inches in the foothills and mountains surrounding the valley.

The highest intensity of rainfall occurs in the Mayacamas Mountains. In parts of this area between Cobb Mountain and Mt. St. Helena, the annual precipitation is 80 inches. Cobb Mountain has an elevation of 4,722 feet above mean sea level. At this elevation, the highest in the unit, and at lower elevations in the mountain ranges surrounding the valley, small amounts of precipitation occur as snow. An annual precipitation of 60 to 70 inches occurs in several other mountain areas in the unit.

Runoff

Mean annual natural runoff from the Russian River Hydrographic Unit is about 1,688,900 acre-feet, or approximately 18.4 inches depth over the 1,721 square mile area of the unit. Due to the topography and geology of the unit, streamflow is highly responsive to rainfall, and the pattern of runoff follows closely the seasonal distribution or precipitation.

Most of the watershed consists of fairly heavy and shallow soils underlain by rather dense impervious bedrock, so that watershed infiltration rates are naturally low. These naturally low rates have been further reduced through soil structure deterioration and lowered humus content resulting from overgrazing and trampling, burning, and cultivation. Storms of large volume and high intensity are typical of the watershed and usually occur simultaneously over large areas. These widely distributed high-intensity storms, together with low infiltration rates, cause high peak rates of runoff and almost simultaneous peaking in most tributaries which overtax the capacities of the main streams, and result in frequent flooding of the river lowlands.

The variation of surface runoff in the Russian River area is well illustrated by streamflow records of the gaging station, "Russian River near Guerneville." Mean monthly flows at this station are 6,350 to 6,650 cubic feet per second during the months of January and February, and about 150 to 180 cubic feet per second during August and September. Extremes in flow during the station's 21 years of record have varied from 90,000 to less than 100 cubic feet per second, and seasonal yields have ranged from 646,390 to 3,446,630 acre-feet.

Water Development

Surface water development within the Russian River Hydrographic Unit controls only a minor portion of the unit's surface runoff. At present there is one existing major project, Coyote Reservoir, located on the EastFork of the Russian River. This is a multiple-purpose reservoir with a gross storage capacity of 122,500 acre-feet with provisions ultimately to increase the gross storage capacity to 199,000 acre-feet when a need for further water conservation becomes necessary. Runoff on the mainstem of the Russian River during the dry season is sustained by releases from Coyote Dam to satisfy irrigation and water supply requirements downstream and maintain a minimum flow of 125 cubic feet per second at Guerneville. Diversions of water are made from the Eel River through the Potter Valley diversion tunnel and powerplant into the East Fork above Coyote Dam. The maximum rate of diversion is 345 cubic feet per second. These diversions which began in 1908 are reregulated by storage in Coyote Reservoir. Currently, there are two exports of water from the Russian River Basin. The first diversion is located some 9 miles southeast of Santa Rosa on Copeland Creek. The original diversion was initiated by the Petaluma Power and Water Company in 1907. In 1943 the California Water Service began operating the diversion. Water is taken from the creek by gravity flow through an 8-inch pipeline to Petaluma Reservoir. Water rights exist for a direct diversion of 1.0 cubic foot per second. This diversion serves about 500 domestic connections.

The second export was initiated during the early 1960's when the Sonoma County Flood Control and Water Conservation District began exporting a small quantity of water from the Russian River Hydrographic Unit to the cities of Sonoma and Petaluma and to other water users in the vicinity of these cities. It is estimated that this export will increase to about 21,000 acre-feet annually by 1980.

The Flood Control Act of 1962 included authorization for the construction of a multiple-purpose dam and reservoir on Dry Creek in Sonoma County. The dam will be located on Dry Creek about 14 miles upstream from its confluence with the Russian River and just below the junction of Warm Springs and Dry Creeks. The project will provide flood control along Dry Creek below the dam, and along the reaches of the Russian River below Dry Creek. It will make an additional supply of 90,000 acre-feet of water available for municipal and industrial purposes, and will include facilities for outdoor recreation. Gross capacity of the reservoir will be 277,000 acre-feet.

Stream Gaging Stations and Records

All stream gaging stations in the Russian River Hydrographic Unit have relatively short records, the longest records being 21 years in length. However, since the available records correlate well with nearby long-term stations, these records are considered adequate to estimate the natural streamflow within the unit. Table 83 lists all gaging stations within the unit, as shown in the department's "Index of Gaging Stations in and Adjacent to California." The locations of stations utilized in preparing this report are shown on Plate 1.

TABLE 83

STREAM GAGING STATIONS IN THE RUSSIAN RIVER HYDROGRAPHIC UNIT

USGS station number	DWR ref. No.	Station	Drainage area in sq. miles	Period of record
11-4672-00	F91010	Austin Cr. nr. Cazadero	63	1959-date
*11-4670-00	F91100	Russian Riv. nr. Guerneville	1,342	1939-date
11-4655-00	F91150	Mark West Cr. nr. Windsor	49	1940-1941
11-4660-00	F91200	Santa Rosa Cr. at Santa Rosa	53	1939-1941
11-2148-00	F91220	Santa Rosa Cr. nr. Santa Rosa	12	1959-date
*11-4640-00	F91400	Russian Riv. nr. Healdsburg	791	1939-date
11-4652-00	F91440	Dry Cr. nr. Geyserville	162	1959-date
11-4650-00	F91450	Dry. Cr. nr. Healdsburg	148	1939-1942
*11-4645-00	F91490	Dry. Cr. nr. Cloverdale	88	1941-date
11-4635-00	F91540	Russian Riv. at Geyserville	656	1910-1913
11-4632-00	F91600	Big Sulphur Cr. nr. Cloverdale	82	1957-date
*11-4630-00	F91680	Russian Riv. nr. Cloverdale	502	1951-date
11-4627-00	F91730	Feliz Cr. nr. Hopland	31	1958-date
*11-4625-00	F91765	Russian Riv. nr. Hopland	362	1939-date
*11-4610-00	F91850	Russian Riv. nr. Ukiah	100	1911-1913 1952-date
*11-4620-00	F94101	Russian Riv. E. Fk. nr. Ukiah	105	1911-1913 1951-date
*11-4615-00	F94200	Russian Riv. E. Fk. nr. Calpella	93	1941-date
	F94300	Russian Riv. E. Fk. trib. nr. Potter Valley	1	1958-date

*Stations for which unimpaired flows are tabulated in this report.

Streamflow Estimates

Estimates of monthly and annual natural flow for the 50-year period from 1910-11 through 1959-60 were compiled for all gaging stations within the Russian River Hydrographic Unit for which five or more years of record were available. A brief description of the methods used for individual gaging stations is included with tabulations of streamflow, Tables 85 through 92. Detailed data on correlations used, other correlations attempted, adjustment factors, etc., are available in the files of the North Coastal Area Investigation.

Mean seasonal full natural flow for the 50-year period from 1910-11 through 1959-60 for the gaging stations are summarized in Table 84.

Estimated mean monthly distribution of natural runoff from the Russian River Hydrographic Unit by subunits is presented on Table 93.

TABLE 84

SUMMARY OF MEAN SEASONAL NATURAL FLOWS
IN THE RUSSIAN RIVER HYDROGRAPHIC UNIT
FOR THE 50-YEAR PERIOD FROM 1910-11 THROUGH 1959-60

Gaging station, subunit, or intermediate areas between gages	Mean full natural flow (in acre-feet)	
East Fork Russian River near Calpella	(77,600)	
Calpella to Ukiah	3,400	
East Fork Russian River near Ukiah	(81,000)	
Subtotal, East Fork Russian River Watershed		81,000
Russian River near Ukiah	114,300	
Russian River near Ukiah	(114,300)	
Ukiah to Hopland	120,400	
Russian River near Hopland	(315,700)	
Hopland to Cloverdale	135,300	
Russian River near Cloverdale	(451,000)	
Cloverdale to Healdsburg	312,000	
Russian River near Healdsburg	(763,000)	
Healdsburg to Guerneville	83,000	
Dry Creek near Cloverdale	(103,700)	
Dry Creek Watershed	250,300	
Mark West Subunit	85,600	
Santa Rosa Subunit	66,900	
Laguna Subunit	72,900	
Russian River near Guerneville	(1,322,900)	
Austin Creek Subunit	107,500	
Guerneville to Mouth	80,600	
Subtotal Russian River Watershed		1,510,000
Bodega Subunit	113,600	
Walker Creek Subunit	65,200	
Subtotal Bodega and Walker Creek Subunits		178,800
Total Russian River Hydrographic Unit		1,688,900

TABLE 85

RUNOFF OF EAST FORK RUSSIAN RIVER NEAR CALPELLA

Location: Lat. 39° 14' 35", Long 123° 08' 10" in NW 1/4 Sec. 13 T16N, R12W, on left bank 0.5 mile downstream from Cold Creek and 3.6 miles east of Calpella.
Drainage area: 93 square miles.
Records available: October 1941 to date.
Recorded extremes: Maximum discharge 13,300 cfs (December 21, 1955); minimum daily discharge 3.8 cfs (October 30, 31, 1959).
Remarks: Since 1908 flow at this station has included imports from the South Eel River. Present monthly imports average about 195 second feet. Numerous irrigational diversions are above the station.

Streamflow at this station was impaired furing the 50-year study period by irrigation diversions; recorded flows were adjusted to correct for consumptive use of applied water. Adjustments were also made for imported Eel River water.

Estimates of seasonal natural flows for 1910-11 through 1940-41 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$Y = -10,550 + .1970\ X$$

Y = seasonal full natural flow, East Fork Russian River near Calpella

X = seasonal full natural flow, Eel River at Van Arsdale Dam near Potter Valley

$\bar{r}$ = correlation coefficient = 0.9872

$\bar{S}y$ = standard error of estimate = 7,870 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing

TABLE 85 (Continued)

program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as a base station.

Monthly and seasonal full natural flows at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 85 (CONTINUED)

RUNOFF OF EAST FORK RUSSIAN RIVER NEAR CALPELLA

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F94200
LOCATION LAT 39-14-35N, LONG 123-08-10W
NE1/4 SEC 13, T16N, R12W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 94 SQ. MILES

EAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
911	200	500	2700	22000	15900	27500	10500	1900	0	0	0	0	81200
912	300	300	700	10200	4900	9600	4500	3600	0	0	0	100	34200
913	400	4200	8200	28200	9500	7200	6800	1300	0	0	0	0	65800
914	100	1200	23100	86300	31300	17500	6000	1000	0	0	0	0	166500
915	500	300	3300	27100	59800	24200	10800	5000	100	0	0	0	131100
916	200	500	13900	36900	36900	23100	4100	900	0	0	0	0	116500
917	200	500	5200	7400	31300	14200	10400	1900	0	0	0	0	71100
918	100	200	1900	1400	7600	11300	3500	400	0	0	0	0	26400
919	200	600	1600	15900	28500	19600	5500	1000	0	0	0	0	72900
920	200	100	2100	700	400	4000	7600	500	0	0	0	0	15600
921	300	12300	30300	36600	25900	15600	4100	900	0	0	0	0	126000
922	100	300	3600	3200	19600	11100	6900	1600	0	0	0	0	46400
923	900	1400	14100	12000	7100	3300	7000	600	0	0	0	0	46400
924	0	100	0	200	400	100	0	0	0	0	0	0	800
925	1000	2600	12700	7800	43800	9100	11100	3100	0	0	0	0	91200
926	400	400	1600	5000	23000	3900	5800	400	0	0	0	0	40500
927	300	7800	17800	33900	60500	17400	12100	1400	0	0	0	0	151200
928	500	2300	4400	13700	14200	30400	9800	800	0	0	0	0	76100
929	100	700	3600	2500	5500	2600	1700	400	0	0	0	0	17100
930	100	100	15600	14400	11400	12500	3400	700	0	0	0	0	58200
931	100	100	200	4800	1800	3700	500	100	0	0	0	0	11300
932	200	600	17900	12600	5600	6200	2400	1100	0	0	0	0	46600
933	0	300	1900	4400	5500	17200	3800	1600	0	0	0	0	34700
934	300	200	9300	7100	6000	4700	1400	300	0	0	0	0	29300
935	300	3400	3800	18200	10100	16300	15800	1300	0	0	0	0	69200
936	200	200	1900	39200	33100	9700	5000	600	0	0	0	0	89900
937	100	100	500	700	12100	18900	8900	1300	0	0	0	0	42600
938	400	11500	41700	17700	51500	58800	13600	2500	0	0	0	0	197700
939	400	600	4300	3700	4200	6900	1100	300	0	0	0	0	21500
940	100	200	5800	33100	52000	30300	7000	800	0	0	0	0	129300
941	200	400	33700	44900	33800	29400	17600	2300	0	0	0	0	162300
942	500	300	36100	26900	44200	5400	12600	4300	500	0	0	400	131200
943	1000	3700	21000	44700	9100	9900	5000	1800	0	0	0	0	96200
944	800	400	900	6200	8200	13000	1900	700	0	0	0	0	32100
945	600	5600	11400	3700	16000	16900	3400	1100	0	0	0	0	58700
946	0	5800	50500	21600	7900	5200	2300	0	0	0	0	0	93300
947	600	1200	3100	1200	7400	15200	1700	0	0	0	0	0	30400
948	400	0	0	8100	4000	14300	23400	4600	0	0	0	0	54800
949	300	0	3900	3000	13200	30600	1700	0	0	0	0	0	52700
950	0	0	0	19700	16000	13900	5700	800	0	0	0	0	56100
951	1500	6000	32900	40800	27800	9700	800	1500	0	0	0	0	121000
952	300	3600	38000	42300	30000	19800	3000	0	0	0	0	0	137000
953	100	400	31900	57500	3200	10500	4000	1400	0	0	0	0	109000
954	0	2200	3200	33000	18200	15100	14100	800	0	0	0	0	86600
955	200	800	8800	10500	3000	2400	2600	0	0	0	0	0	28300
956	800	1600	60600	62200	38100	7700	0	0	0	0	0	0	171000
957	300	1000	600	8600	16600	18100	3000	4900	0	0	0	0	53100
958	4800	3200	13100	31400	82800	25700	31800	1100	0	0	0	0	193900
959	400	0	500	16580	24500	3400	1600	0	0	0	0	100	47000
960	1400	1300	400	3100	29700	21500	3100	1200	0	0	0	0	61700
TAL	22400	91100	604300	992800	1053100	724600	330400	63800	600			600	3883700
AN	400	1800	12100	19900	21100	14500	6600	1300	0	0	0	0	77700
RCENT	0.5	2.3	15.6	25.6	27.1	18.7	8.5	1.7	0.0	0.0	0.0	0.0	100.0

TABLE 86

RUNOFF OF EAST FORK RUSSIAN RIVER NEAR UKIAH

Location: Lat. 39° 11' 45", Long. 123° 11' 30" on right bank of outlet channel 500 feet downstream from Coyote Dam and 3.2 miles northeast of Ukiah, Mendocino County.
Drainage area: 105 square miles.
Records available: October 1951 to June 1956, October 1957 to date.
Recorded extremes: Maximum discharge 13,300 cfs (December 21, 1955); no flow August 13-15, 1913.
Remarks: Flow regulated by Coyote Reservoir beginning December 1958. (Usable capacity 118,000 acre-feet.) Flow since 1908 includes imported Eel River water. Numerous irrigational diversions are above the station.

Streamflow at this station was impaired during the 50-year study period by irrigation diversions; recorded flows were adjusted to correct for consumptive use of applied water. Adjustments were also made for regulation by Coyote Reservoir (December 1958 to September 1960) and for imported Eel River water.

Estimates of seasonal natural flows for 1910-11 through 1940-41 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$Y = .1969\ X - 7350$$

Y = seasonal full natural flow, East Fork Russian River near Ukiah

X = seasonal full natural flow, Eel River at Van Arsdale Dam near Potter Valley

$\bar{r}$ = correlation coefficient = 0.9848

$\bar{S}y$ = standard error of estimate = 8,580 acre-feet

The monthly distribution of estimated seasonal flows was determined by the percent deviation method, using data processing

TABLE 86 (Continued)

program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as the base station.

Monthly and seasonal full natural flow at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 86 (CONTINUED)

RUNOFF OF EAST FORK RUSSIAN RIVER NEAR UKIAH

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F94100
LOCATION LAT 39-11-45N, LONG 123-11-30W

SOURCE OF RECORD USGS
UNIT ACRE FEET
AREA 105 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	200	600	2900	27000	20000	23200	9700	400	300	0	0	0	84300
1912	400	400	800	14100	6900	9100	4700	700	300	0	0	0	37400
1913	400	4500	8100	32700	11300	5700	6000	200	100	0	0	0	69000
1914	100	1200	21600	93700	34700	13100	4900	200	100	0	0	0	169600
1915	600	300	3300	31000	69500	18900	9300	800	500	0	0	0	134200
1916	200	500	13500	41600	42300	17900	3400	100	100	0	0	0	119600
1917	200	500	5300	8800	37900	11600	9400	300	200	0	0	0	74200
1918	200	200	2200	1900	10700	10700	3600	100	0	0	0	0	29600
1919	200	700	1600	18700	34000	15800	4800	200	100	0	0	0	76100
1920	200	200	2800	1200	700	4400	9200	100	0	0	0	0	18800
1921	300	12700	29300	41200	29700	12100	3500	200	100	0	0	0	129100
1922	100	400	3800	4000	24800	9500	6500	300	200	0	0	0	49600
1923	1100	1500	14600	14500	8700	2700	6300	100	100	0	0	0	49600
1924	100	200	200	900	2300	200	100	0	0	0	0	0	4000
1925	1100	2800	12600	8900	51300	7200	9700	500	200	0	0	0	94300
1926	400	500	1600	5800	27100	3100	5000	100	0	0	0	0	43600
1927	300	7900	17000	37500	68100	13100	10100	200	100	0	0	0	154300
1928	600	2700	4700	17300	18200	26200	9300	200	100	0	0	0	79300
1929	100	900	4200	3300	7400	2400	1700	100	100	0	0	0	20200
1930	100	100	16200	17300	14000	10400	3100	100	0	0	0	0	61300
1931	100	200	300	7000	2600	3700	600	0	0	0	0	0	14500
1932	200	700	18800	15400	7000	5200	2200	200	100	0	0	0	49800
1933	100	300	2300	6200	7900	16600	4000	300	200	0	0	0	37900
1934	400	200	10000	8800	7600	4000	1400	100	0	0	0	0	32500
1935	300	3800	4100	22500	12700	13900	14700	200	100	0	0	0	72300
1936	300	200	1800	42600	36700	7200	4100	100	100	0	0	0	93100
1937	100	100	600	1000	16800	17600	9200	300	100	0	0	0	45800
1938	400	12700	42900	21200	62600	48200	12200	400	200	0	0	0	200800
1939	600	800	5000	5000	5700	6400	1100	0	0	0	0	0	24600
1940	100	200	5700	37300	59600	23400	5900	100	100	0	0	0	132400
1941	200	500	33600	52000	39800	23400	15300	400	200	0	0	0	165400
1942	500	300	35000	32700	50200	3300	9300	100	2600	0	0	0	134000
1943	900	3200	20400	54300	10400	6000	3800	100	0	0	0	0	99100
1944	1100	500	1000	9400	11700	9900	1800	0	0	0	0	0	35400
1945	700	5800	13200	5300	21600	12200	3000	100	0	0	0	0	61900
1946	0	5100	50000	27000	9200	3200	1800	0	0	0	0	0	96300
1947	800	1400	4100	1900	11400	12400	1700	0	0	0	0	0	33700
1948	500	0	0	13800	6500	12300	24700	200	0	0	0	0	58000
1949	400	0	5000	4700	19800	24400	1600	0	0	0	0	0	55900
1950	0	0	0	27200	20500	9500	2000	0	0	0	0	0	59200
1951	1400	5100	31300	48600	31000	5700	600	100	0	0	0	0	123800
1952	400	3400	38700	45700	32800	20400	3800	200	0	0	0	0	145400
1953	0	1200	32000	64300	3800	9000	3300	1700	0	0	0	0	115300
1954	300	1900	2500	32100	16600	13400	11800	0	0	0	0	0	78600
1955	500	2600	10200	11400	3700	2900	2500	0	0	0	0	0	33800
1956	600	1500	61600	62600	39100	9300	1200	100	0	0	0	0	176000
1957	400	1200	700	13300	23900	13800	2800	200	0	0	0	0	56300
1958	4800	3400	13600	30900	84300	25400	28500	1900	1800	0	0	0	194600
1959	800	0	300	17400	27900	3800	1300	0	0	0	0	0	51500
1960	600	700	0	3900	34700	21200	2500	1300	0	0	0	0	64900
TOTAL	24400	95800	611000	1146900	1237700	605000	299000	13000	8100				4040900
MEAN	500	1900	12200	22900	24700	12100	6000	300	200	0	0	0	80800
PERCENT	0.6	2.4	15.1	28.3	30.6	15.0	7.4	0.4	0.2	0.0	0.0	0.0	100.0

TABLE 87

RUNOFF OF RUSSIAN RIVER NEAR UKIAH

Location: Lat. 39° 12' 10", Long. 123° 12' 00" on left bank 200 feet downstream from York Creek, 0.7 mile upstream from East Fork, and 3.6 miles north of Ukiah, Mendocino County.
Drainage area: 100 square miles.
Records available: October 1952 to date.
Recorded extremes: Maximum discharge 18,900 cfs (December 21, 1955); no flow at times in 1911, 1952-53, 1960.
Remarks: Small diversions above station for irrigation.

Streamflow at this station was impaired slightly during the 50-year study period by irrigation diversions; recorded flows were adjusted to correct for consumptive use of applied water.

Estimates of seasonal natural flows for 1910-11 through 1951-52 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$\text{Log } Y = \text{Log } 240 + 1.0093 \text{ Log } X$$

Y = seasonal full natural flow, Russian River near Ukiah

X = seasonal full natural flow, Eel River at Van Arsdale Dam near Potter Valley

$\bar{r}$ = correlation coefficient = 0.9878

$\bar{S}y$ = standard error of estimate = 15,830 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as the base station.

Monthly and seasonal full natural flows at this station for the 50-year period from 1910-11 through 1959-60 are tabulated on the following page.

TABLE 87 (CONTINUED)

RUNOFF OF RUSSIAN RIVER NEAR UKIAH

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F91850
LOCATION LAT 39-12-10N, LONG 123-12-00W

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 100 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTA
1911	300	900	4200	33000	23300	32900	17600	4000	1800	400	100	100	11860
1912	500	500	1100	16400	7700	12400	8000	8200	1800	400	100	300	5740
1913	500	6700	12400	41600	13600	8400	11300	2700	900	300	200	0	9860
1914	200	1800	33100	120400	42500	19500	9400	2000	900	300	100	100	23030
1915	600	400	4800	38200	81800	27100	17000	9900	3000	600	300	100	18380
1916	300	800	20800	54000	52400	26900	6600	1800	600	300	100	100	16470
1917	300	700	7900	11000	45600	16900	17400	4000	1100	200	200	100	10540
1918	200	400	3600	2600	14100	17300	7500	1100	300	100	100	100	4740
1919	300	1100	2600	24600	42900	24100	9400	2100	400	100	100	100	10780
1920	200	300	4400	1500	800	6600	17700	1500	300	100	0	0	3340
1921	400	18700	43800	51700	35500	17500	6400	1900	800	200	100	100	17710
1922	100	600	5800	5100	30300	14100	12200	3600	1000	300	100	100	7330
1923	1300	2300	22300	18600	10700	4000	12000	1200	500	200	100	100	7330
1924	400	800	700	3000	7800	800	600	200	100	0	0	0	1440
1925	1300	4000	18600	11100	60500	10300	17600	6200	1500	300	100	100	13160
1926	500	800	2700	8200	36500	5000	10500	1000	200	100	100	0	6560
1927	400	11800	25700	47600	82600	19400	18900	2800	700	200	100	0	21020
1928	700	3900	7000	21500	21600	37700	17100	1800	400	200	100	0	11200
1929	100	1600	7600	5100	10900	4300	3800	1100	500	200	100	0	3530
1930	100	100	25000	22500	17400	15600	6000	1400	300	100	100	0	8860
1931	100	400	600	12400	4500	7600	1600	300	200	100	0	0	2780
1932	300	1100	28800	19700	8500	7800	4300	2400	400	100	100	0	7350
1933	100	500	3300	7800	9200	24000	7400	4000	1200	400	100	100	5810
1934	500	300	16900	12500	10400	6600	2800	800	200	100	0	0	5110
1935	400	5500	5900	27200	14700	19500	26200	2700	500	200	100	0	10290
1936	300	300	2800	57300	47200	11300	8200	1200	1000	300	100	0	13000
1937	100	200	800	1300	19700	25200	16600	3200	900	300	100	100	6850
1938	500	17700	61000	25300	71400	66700	21600	5100	1300	300	200	100	27120
1939	800	1300	8800	7400	8100	11100	2300	800	200	100	100	0	4100
1940	100	200	8800	48700	74300	35500	11500	1700	400	200	100	0	18150
1941	300	600	48400	62900	46000	32700	27400	4700	1200	400	100	100	22480
1942	400	900	50700	47700	53400	6900	13200	4200	1600	300	200	100	17960
1943	200	3700	22300	60100	17200	14700	7000	2000	700	200	100	0	12820
1944	100	400	1600	9100	10500	17800	5300	2100	600	200	100	0	4780
1945	200	6000	16700	8500	29300	12900	8200	1800	600	200	100	0	8450
1946	1600	7200	58500	27300	9300	7800	4900	1000	200	100	0	0	11790
1947	0	3800	7900	1600	14700	21200	5500	600	600	200	100	0	5620
1948	3700	1200	2000	28500	6600	14600	33300	6400	1800	400	100	100	9870
1949	400	1100	5600	5200	15300	33100	10200	2000	400	200	100	0	7360
1950	100	600	1000	23600	23900	17100	10200	2100	500	200	100	0	7940
1951	6600	9500	46500	46400	31600	11400	3500	2500	500	200	100	0	15880
1952	100	6400	51300	39900	55700	22600	12600	3900	1000	300	100	100	19400
1953	0	0	47400	80300	4300	15800	6400	4700	2100	400	200	100	16170
1954	400	4100	7400	44200	25300	20800	18200	1900	800	200	100	100	12350
1955	100	1500	14400	17600	4100	3600	8000	2600	300	200	100	100	5260
1956	100	1600	100800	96600	50800	11200	2400	1500	500	200	100	100	26590
1957	800	700	500	17700	31300	30700	4900	7900	1100	200	100	100	9600
1958	8800	9000	18600	34000	109700	28100	39100	2500	1200	400	100	100	25160
1959	100	700	2400	32100	31300	5300	2700	700	300	200	100	0	7590
1960	100	100	100	6700	56600	35500	4500	2600	800	300	100	100	10750
TOTAL	36000	144800	895900	1447300	1533400	899900	557000	138400	40200	11700	5200	2800	571260
MEAN	700	2900	17900	28900	30800	18000	11100	2800	800	200	100	100	11430
PERCENT	0.6	2.5	15.7	25.3	27.0	15.7	9.7	2.4	0.7	0.2	0.1	0.1	100.

TABLE 88

RUNOFF OF RUSSIAN RIVER NEAR HOPLAND

Location: Lat 39° 01' 35", Long. 123° 07' 45" on right bank at abandoned highway bridge, 0.2 mile downstream from McNab Creek, 4 miles north of Hopland, Mendocino County.
Drainage area: 362 square miles.
Records available: October 1939 to date.
Recorded extremes: Maximum discharge 45,000 cfs (December 22, 1955); minimum discharge 26 cfs (December 18, 1943, June 26, 1949).
Remarks: Flow regulated by Coyote Reservoir beginning December 1958. (Usable capacity 118,000 acre-feet.) Flow since 1908 included imported Eel River water. Numerous irrigational diversions are above the station.

Streamflow at this station was impaired furing the 50-year study period by irrigation diversions; recorded flows were adjusted to correct for consumptive use of applied water. Adjustments were also made for regulation by Coyote Reservoir (December 1958 to September 1960) and for imported Eel River water.

Estimates of seasonal natural flows for 1910-11 through 1940-41 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$Y = .7701\ X - 28{,}140$

Y = seasonal full natural flow, Russian River near Hopland

X = seasonal full natural flow, Eel River at Van Arsdale Dam near Potter Valley

$\bar{r}$ = correlation coefficient = 0.9773

$\bar{S}y$ = 42,510 acre-feet

TABLE 88 (Continued)

The monthly distribution of estimated seasonal flows was determined by the percent deviation method using data processing program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as the base station.

Monthly and seasonal full natural flow at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 88 (CONTINUED)

RUNOFF OF RUSSIAN RIVER NEAR HOPLAND

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F91765
LOCATION LAT 39-01-35N, LONG 123-07-45W

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 362 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	400	2100	10000	83600	66000	106700	47100	11400	2900	0	200	100	330500
1912	700	1200	2500	39100	20500	37500	20300	21700	2700	0	200	400	146800
1913	800	16800	31200	110600	40900	28600	31700	8000	1500	0	200	100	270400
1914	300	4600	87200	334600	132500	69400	27600	6100	1500	0	100	100	664000
1915	1000	1100	11900	99800	240000	90700	47100	28600	4900	100	300	100	525600
1916	500	1900	52200	142600	155200	91100	18500	5200	1000	0	200	100	468500
1917	500	1700	18800	27800	128500	54300	46300	11100	1700	0	200	100	291000
1918	300	700	7500	5700	34300	47800	17100	2600	300	0	100	100	116500
1919	500	2500	6100	61100	119500	77000	24800	5800	700	0	100	100	298200
1920	300	500	8600	3100	1900	17400	38500	3400	300	0	0	0	74000
1921	600	48800	114800	142900	110000	62200	18700	5800	1400	0	100	100	505400
1922	200	1400	13300	12300	81500	43400	31100	9600	1400	0	200	100	194500
1923	2100	5700	55400	48600	31300	13600	33200	3600	900	0	100	100	194600
1924	300	800	700	3200	9100	1200	600	300	100	0	0	0	16300
1925	2100	9800	46200	29000	178100	34500	49000	17900	2400	0	200	100	369300
1926	800	1800	6200	19600	98000	15300	26600	2600	300	0	100	0	171300
1927	600	29900	65500	128100	249300	66800	54000	8400	1200	0	100	100	604000
1928	1100	9200	16400	53200	60000	120100	44900	5000	700	0	100	0	310700
1929	200	3300	15400	11000	26100	11700	8700	2600	700	0	100	0	79800
1930	100	300	60700	57600	49800	51100	16200	4100	500	0	100	0	240500
1931	100	700	1100	23400	9400	18600	3100	600	200	0	0	0	57200
1932	500	2600	70800	51200	24800	26000	11600	6900	700	0	100	0	195200
1933	100	1000	7400	17500	23700	69500	17700	9900	1700	0	200	100	148800
1934	800	700	38500	30100	27700	20300	7200	2000	300	0	100	0	127700
1935	600	13200	14300	69600	42100	63800	71300	7600	800	0	100	100	283500
1936	500	800	7100	150800	139200	38000	22800	3600	1600	0	100	100	364600
1937	100	400	1800	2900	50600	73900	40600	8000	1300	0	100	100	179800
1938	800	44500	154000	67400	213200	227700	60900	14900	2200	0	200	100	785900
1939	1100	2700	18300	16100	20000	30800	5700	1900	300	0	100	0	97000
1940	0	0	2800	79900	202500	98300	36200	5600	0	0	0	0	425300
1941	100	800	95500	179700	147900	108300	105400	12500	3000	100	0	100	653400
1942	500	1200	155500	109800	168900	27700	47800	16400	4300	200	700	400	533400
1943	300	11600	72800	171400	42400	30700	21000	8200	2400	100	200	100	361200
1944	900	1600	3100	26200	36400	56900	7100	3500	100	0	0	0	135800
1945	300	22200	48000	18700	76800	65000	18000	6300	1700	0	0	0	257000
1946	200	26600	212700	88200	28500	25600	13100	2900	0	0	0	0	397800
1947	800	6100	11800	4000	29200	59300	11700	1000	0	0	0	0	123900
1948	2300	1800	1100	34000	19200	53900	88500	22600	4400	0	0	0	227800
1949	800	0	18800	15700	64000	133500	12000	3400	0	0	500	0	248700
1950	0	0	400	64700	59600	53700	19000	5400	600	0	0	0	203400
1951	5000	24600	128400	160200	100400	46500	6800	9100	0	0	0	0	481000
1952	0	12000	147200	178600	134000	86000	14100	3000	0	0	0	0	574900
1953	400	1700	100100	225800	15600	43100	18600	12200	3400	0	0	0	420900
1954	100	9800	15100	118500	72200	66900	59200	5600	500	0	0	0	347900
1955	500	3300	39200	48800	15500	12900	20900	6000	0	0	0	0	147100
1956	400	2500	255000	245000	157500	48600	8500	2900	600	0	0	0	721000
1957	1400	4900	3500	34100	75500	77500	21300	25400	5400	0	0	0	249000
1958	19500	19600	48200	122900	362800	90400	110300	4500	1500	300	1600	0	781600
1959	2200	0	1300	57000	96100	18200	9400	600	100	0	0	600	185500
1960	900	1500	1000	16700	135300	72100	12000	6200	0	200	800	400	247100
TOTAL	54600	362500	2305400	3842400	4423500	2884100	1503800	382500	64200	1000	7500	3800	15835300
MEAN	1100	7300	46100	76800	88300	57700	30100	7700	1300	0	200	100	316700
PERCENT	0.3	2.3	14.6	24.3	27.9	18.2	9.5	2.4	0.4	0.0	0.1	0.0	100.0

TABLE 89

RUNOFF OF RUSSIAN RIVER NEAR CLOVERDALE

Location: Lat. 38° 52' 55", Long. 123° 03' 15" in SW 1/4 Sec. 14, T12N, R11W, on left bank of Lambert Ranch, 400 feet downstream from Cumminsky Creek and 5 miles northeast of Cloverdale.
Drainage area: 502 square miles.
Records available: July 1951 to date.
Recorded extremes: Maximum discharge 53,000 cfs (December 22, 1955); minimum discharge 81 cfs (November 24, 1958).
Remarks: Flow regulated by Coyote Reservoir beginning December 1958. (Usable capacity 118,000 acre-feet.) Flow since 1908 includes imported Eel River water. Numerous irrigational diversions are above the station.

Streamflow at this station was impaired during the 50-year study period by irrigation diversions; recorded flows were adjusted to correct for consumptive use of applied water. Adjustments were also made for regulation by Coyote Reservoir (December 1958 to September 1960) and for imported Eel River water.

Estimates of seasonal natural flows for 1910-11 through 1950-51 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$\text{Log } Y = 163.64 + .0008\ X$$

Y = seasonal full natural flow, Russian River near Cloverdale

X = seasonal full natural flow, Eel River at Van Arsdale Dam near Potter Valley

$\bar{r}$ = correlation coefficient = 0.9887

$\bar{S}y$ = 39,180 acre-feet

The monthly distribution of estimated seasonal flows was determined by the percent deviation method, using data processing

TABLE 89 (Continued)

program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as the base station.

Monthly and seasonal full natural flow at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 89 (CONTINUED)

RUNOFF OF RUSSIAN RIVER NEAR CLOVERDALE

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F91680
LOCATION LAT 38-52-55N, LONG 123-03-15W
SW1/4 SEC. 14, T12N, R11W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 502 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	700	2600	13100	110900	81000	118400	63200	14800	3400	200	300	300	408900
1912	1600	2000	4600	71900	34700	57600	37800	39200	4400	300	400	1300	255800
1913	1400	20900	41200	148500	50700	32200	43100	10500	1700	200	300	100	350800
1914	500	6400	128000	500300	183100	86800	41700	9000	2000	200	200	200	958400
1915	1800	1400	16000	136400	303100	103700	65100	38400	6000	300	500	200	672900
1916	800	2300	67600	188000	189200	100500	24700	6700	1200	200	300	200	581700
1917	800	2200	25100	37700	161000	61700	63600	14900	2100	100	300	200	369700
1918	1000	1500	16300	12700	70500	89000	38600	5800	700	100	200	400	236800
1919	800	3200	8100	83200	150400	87600	34200	7700	800	100	200	200	376500
1920	1200	1500	25100	9200	5200	43200	115700	10000	900	100	100	200	212400
1921	1100	60000	149600	189500	135000	69100	25100	7600	1600	100	200	200	639100
1922	300	2100	20800	19600	120400	57900	50100	15000	2000	200	300	200	288900
1923	4200	8100	83000	74000	44100	17300	51200	5400	1200	100	200	200	289000
1924	4000	8500	8200	37800	101200	11500	7600	3400	600	100	200	200	183300
1925	3500	11800	58600	37400	212800	37300	64000	22700	2700	200	300	200	451500
1926	1700	2800	10200	33000	152600	21600	45300	4300	500	100	100	100	272300
1927	1200	39800	92500	184300	331600	80400	78600	11900	1500	100	200	100	822200
1928	1900	11600	21800	72300	75200	136300	61800	6700	800	100	200	100	388800
1929	600	8600	43300	31400	69000	27800	25100	7400	1700	200	300	200	215600
1930	200	400	85200	82200	65700	61100	23400	5700	700	100	100	100	324900
1931	600	2400	4200	88700	33100	59000	12000	2400	600	100	200	200	203500
1932	900	3700	107300	78900	35300	33400	18100	10500	1000	100	100	100	289400
1933	200	1700	13700	33300	41600	110500	34000	18500	2800	200	400	200	257100
1934	2000	1400	75600	60100	51100	34000	14600	4000	500	100	100	100	243600
1935	1000	16500	18900	93600	52400	71800	97100	10000	1000	100	200	100	362700
1936	800	900	8900	193300	164900	40800	29600	4600	1800	200	200	100	446100
1937	300	600	3000	4900	79200	104600	69700	13300	2000	200	300	200	278300
1938	1900	74200	272000	121200	354600	342600	110900	26400	3500	200	400	200	1308100
1939	3600	6300	44800	40300	45900	64200	14300	4800	700	100	200	100	225300
1940	300	800	29100	172300	272700	134600	43500	6600	800	100	200	100	661100
1941	900	2300	182500	254600	193100	142300	119100	20500	2800	200	300	200	918800
1942	1300	2900	172200	173700	201900	26900	52100	16800	3100	200	300	200	651600
1943	500	11100	71400	206400	61500	54100	26200	7400	1200	100	200	100	440200
1944	300	1600	7000	43800	52400	91800	27200	10900	1700	200	300	200	237400
1945	700	19600	57700	31700	112500	51300	32500	7400	1200	100	200	100	315000
1946	4500	22400	194800	97500	34400	29800	18800	3900	400	100	100	100	406800
1947	200	14500	32700	7100	67600	100400	26000	2900	1500	100	300	100	253400
1948	10400	3700	6600	99200	23900	54500	124500	24100	3400	200	300	300	351100
1949	1100	3600	19800	19600	59900	134800	41300	8400	800	100	200	100	289700
1950	200	1800	3300	87300	91800	68000	40400	8500	1100	100	200	100	302800
1951	19100	29700	155200	166100	117400	43700	14000	9600	1000	100	200	100	556200
1952	0	15700	222000	255000	153500	115700	20600	5300	0	0	0	0	787800
1953	0	1400	168500	324400	21700	61700	25900	15400	3600	0	0	0	622600
1954	0	14100	17900	168500	110700	92700	76800	8200	1800	0	0	0	490700
1955	900	9600	57200	61200	19200	17400	34900	12100	0	0	0	0	212500
1956	1000	4100	323600	341600	210500	54200	11500	5000	600	0	0	0	952100
1957	900	3700	2500	44100	109600	114800	27700	38100	5100	0	900	100	347500
1958	25500	19700	70600	170200	506500	152400	195100	14100	5300	800	1400	600	1162200
1959	2000	0	2300	113900	161400	20300	9100	1900	700	600	0	900	313100
1960	1700	2100	1500	23000	190300	111900	23000	9400	400	100	400	700	364500
TOTAL	112100	489800	3265100	5635800	6167100	3835200	2350400	578100	86900	7500	12500	10200	22550700
MEAN	2200	9800	65300	112700	123300	76700	47000	11600	1700	200	300	200	451000
PERCENT	0.5	2.2	14.5	25.0	27.3	17.0	10.4	2.6	0.4	0.0	0.1	0.0	100.0

TABLE 90

RUNOFF OF DRY CREEK NEAR CLOVERDALE

Location: Lat. 38° 44' 59", Long. 123° 05' 28", in NE 1/4 NE 1/4 Sec. 5, T10N, R11W, on left bank 500 feet downstream from Smith Creek and 5 miles southwest of Cloverdale.
Drainage area: 88 square miles.
Records available: October 1941 to date.
Recorded extremes: Maximum discharge 17,600 cfs (December 22, 1955); minimum discharge 0.1 cfs for several days in 1944, 1949, 1951-53.
Remarks: A few diversions for irrigational purposes are above the station.

Streamflow at this station was impaired slightly during the 50-year study period by irrigation diversions, recorded flows were adjusted to correct for consumptive use of applied water.

Estimates of seasonal natural flows for 1910-11 through 1939-40 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$Y = .2381\ X - 2{,}950$

Y = seasonal full natural flow, Dry Creek near Cloverdale

X = seasonal full natural flow, Eel River at Van Arsdale Dam near Potter Valley

$\bar{r}$ = correlation coefficient = 0.9707

$\bar{S}y$ = standard error of estimate = 14,610 acre-feet

The monthly distribution of the estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as the base station.

TABLE 90 (Continued)

Monthly and seasonal full natural flows at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 90 (CONTINUED)

RUNOFF OF DRY CREEK NEAR CLOVERDALE

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F91490
LOCATION LAT 38-44-59N, LONG 123-05-28W
NE1/4 NE1/4 SEC.5, T10N, R11W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 88 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	200	900	3600	26000	21500	32800	15600	4600	2100	400	100	100	107900
1912	300	500	900	12300	6800	11700	6800	8800	1900	500	100	500	51100
1913	400	7200	10900	33800	13100	8700	10400	3200	1000	400	200	100	89400
1914	100	2000	30600	102000	42400	21000	9000	2400	1100	300	100	100	211100
1915	500	500	4100	29900	75600	27000	15100	11100	3400	700	300	100	168300
1916	200	800	18400	43800	50100	27800	6100	2100	700	400	100	100	150600
1917	200	800	6600	8600	41500	16600	15200	4400	1200	300	200	100	95700
1918	200	300	2900	1900	12300	16100	6300	1200	300	100	100	100	41800
1919	200	1100	2200	19200	39500	24000	8400	2400	500	200	100	100	97900
1920	200	300	3500	1100	700	6100	14700	1600	300	100	0	0	28600
1921	300	20100	38600	41800	33800	18000	5900	2200	900	200	100	100	162000
1922	100	600	4800	3900	27000	13500	10500	3900	1000	400	100	100	65900
1923	1000	2500	19700	15000	10200	4200	10900	1400	600	200	100	100	65900
1924	300	700	500	1900	5900	700	400	200	100	100	0	0	10800
1925	1000	4100	15800	8600	55700	10200	15600	6900	1600	300	100	100	120000
1926	400	800	2300	6300	33300	4900	9200	1100	200	100	100	0	58700
1927	300	12500	22400	38100	77900	19700	17200	3200	800	200	100	100	192500
1928	500	4100	5900	16600	19700	37100	15000	2000	500	200	100	100	101800
1929	100	1600	6100	3800	9500	4000	3200	1200	600	200	100	0	30400
1930	100	100	21900	18000	16400	15900	5400	1600	400	200	100	0	80100
1931	100	400	500	9300	3900	7300	1300	300	200	100	0	0	23400
1932	200	1100	25300	15900	8100	8000	3900	2800	500	200	100	0	66100
1933	0	400	2800	5700	8100	22400	6200	4200	1300	400	100	100	51700
1934	400	300	14600	9900	9600	6600	2600	900	200	100	0	0	45200
1935	300	5700	5100	21500	13700	19500	23600	3000	600	200	100	100	93400
1936	300	300	2500	47100	45700	11800	7600	1500	1100	400	100	100	118500
1937	100	200	700	900	17100	23500	14000	3300	1000	300	100	100	61300
1938	400	18300	51800	19700	65600	66100	19100	5700	1500	300	200	100	248800
1939	600	1300	7200	5500	7200	10500	2100	900	200	100	100	0	35700
1940	100	300	7700	38900	70000	36000	10400	1900	500	200	100	0	166100
1941	200	700	42900	51200	44100	33900	25300	5400	1500	500	200	100	206000
1942	300	1400	46900	41400	55300	10900	21900	6200	2000	600	200	100	187200
1943	100	2500	14200	53200	11700	14500	5500	2300	900	300	100	100	105400
1944	100	200	700	9000	17200	18500	2400	1300	600	200	100	0	50300
1945	100	5300	11800	6600	27800	13500	4900	1700	700	200	100	0	72700
1946	3200	9800	61000	16400	8600	6300	3900	1300	500	200	0	0	111200
1947	0	2500	4500	900	10300	19000	4300	900	800	200	0	0	43400
1948	1300	1000	1600	11600	3100	12100	34600	9000	1700	500	200	0	76700
1949	100	300	6200	4300	14300	57100	3900	1400	400	200	100	0	88300
1950	100	200	600	15800	24900	9300	4600	1400	500	100	100	0	57600
1951	3600	13300	37900	31400	25800	13300	2800	3900	700	300	100	0	133100
1952	200	5500	49300	53300	28300	23300	4600	2000	800	400	100	0	167800
1953	0	500	43300	59400	6600	12300	6400	3900	1400	400	200	100	134500
1954	200	4900	2900	52000	24200	22400	20600	2500	1000	300	200	200	131400
1955	300	5900	18000	11100	4200	2900	10300	3700	800	200	100	0	57500
1956	100	900	92600	63600	40700	10400	3200	1800	500	200	100	100	214200
1957	500	400	400	7500	27200	18500	4900	8700	1000	400	200	600	70300
1958	9800	2800	16800	35800	120200	32400	37300	2300	900	400	300	100	259100
1959	100	200	400	34700	39500	5700	1900	800	300	100	100	400	84200
1960	200	200	300	6700	45800	31500	4600	2000	600	200	0	0	92100
TOTAL	29600	148300	792200	1172900	1421700	899500	499600	152500	43900	13700	5600	4200	5183700
MEAN	600	3000	15800	23500	28300	18000	10000	3100	900	300	100	100	103700
PERCENT	0.6	2.9	15.2	22.7	27.2	17.4	9.6	3.0	0.9	0.3	0.1	0.1	100.0

TABLE 91

RUNOFF OF RUSSIAN RIVER NEAR HEALDSBURG

Location: Lat 38° 36' 48", Long 122° 50' 07", on left bank 2 miles east of Healdsburg, Sonoma County, and 3.5 miles upstream from Dry Creek.
Drainage area: 791 square miles.
Records available: October 1939 to date.
Recorded extremes: Maximum discharge 67,000 cfs (February 28, 1940); minimum discharge 38 cfs (July 2, 1950).
Remarks: Flow regulated by Coyote Reservoir beginning December 1958. (Usable capacity 118,000 acre-feet.) Flow since 1908 includes imported Eel River water. Numerous irrigational diversions are above the station.

Streamflow at this station was impaired during the 50-year study period by irrigation diversions; recorded flows were adjusted to correct for consumptive use of applied water. Adjustments were also made for regulation by Coyote Reservoir (December 1958 to September 1960) and for imported Eel River water.

Estimates of seasonal natural flows for 1910-11 through 1938-39 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$Y = 1.8773\ X - 76{,}670$$

Y = seasonal full natural flow, Russian River near Healdsburg

X = seasonal full natural flow, Eel River at Van Arsdale Dam near Potter Valley

$\bar{r}$ = correlation coefficient = 0.9857

$\bar{S}y$ = standard error of estimate = 81,720 acre-feet

TABLE 91 (Continued)

The monthly distribution of estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as the base station.

Monthly and seasonal full natural flow at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 91 (CONTINUED)

RUNOFF OF RUSSIAN RIVER NEAR HEALDSBURG

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F91500
LOCATION LAT 38-36-48N, LONG 122-50-07W

SOURCE OF RECORD USGS
UNIT ACRE-FEET
AREA 791 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	1300	6100	23800	190200	156700	245600	122500	35200	12900	2200	600	500	797600
1912	1900	3200	5600	83700	45700	81200	49600	63300	11300	2200	500	1500	349700
1913	2400	48700	73400	249500	96100	65300	81800	24500	6500	2100	700	200	651200
1914	900	14100	213900	787800	325200	165200	74300	19600	7000	1900	400	400	1610700
1915	3100	3100	28200	226100	566900	208000	122000	88300	22000	3900	1100	400	1273100
1916	1500	5700	127000	333000	378000	215300	49400	16400	4800	1900	600	400	1134000
1917	1400	5000	44100	62600	301100	123600	119200	34100	7700	1400	700	400	701300
1918	1000	2100	17400	12800	79900	108100	43900	8100	1500	500	300	300	275900
1919	1400	7500	14500	140800	287100	179300	65400	18100	3000	900	400	300	718700
1920	900	1400	18700	6500	4100	36800	92000	9700	1500	400	100	100	172200
1921	1900	143300	272800	325700	261600	143500	48800	18000	6300	1300	400	300	1223900
1922	500	4000	30800	27300	189200	97500	79000	28900	6300	1800	500	300	466100
1923	6300	16400	129400	108700	73100	30800	84900	11000	3900	1200	400	300	466400
1924	600	1800	1400	5800	17500	2100	1300	700	200	100	100	0	31600
1925	6300	28300	107500	64600	414900	78000	125100	54300	10500	1800	600	300	892200
1926	2300	5100	14500	44100	230000	34900	68300	7900	1500	600	200	200	409600
1927	1900	88100	156300	293300	595100	154800	141300	26200	5400	1400	400	200	1464400
1928	3300	27200	39000	121700	142900	277600	117500	15600	3000	1000	400	200	749400
1929	500	9100	34900	23800	59100	25600	21500	7800	2900	900	300	100	186500
1930	300	900	146000	132800	119800	119200	42700	12800	2300	800	300	200	578100
1931	400	2000	2600	51700	21800	41700	7900	1900	800	300	100	100	131300
1932	1400	7500	168000	116400	58800	59700	30200	21400	3200	700	300	200	467800
1933	200	2800	17000	38900	54800	156000	44900	29900	7300	1900	500	300	354500
1934	2300	2100	91300	68300	65600	46700	18800	6300	1100	500	200	100	303300
1935	1700	38100	33400	155900	98400	144700	182700	23100	3500	1000	400	200	683100
1936	1600	2300	17100	350700	337400	89500	60700	11500	7200	2100	500	200	880800
1937	400	1100	4100	6400	117000	165700	103100	24200	5900	1600	500	200	430200
1938	2500	131100	366900	154000	508300	526500	159200	46500	9800	1900	700	300	1907700
1939	3300	7900	42600	36100	46500	69600	14400	5900	1300	500	200	100	228400
1940	0	0	13700	266300	518900	252100	103000	18900	5100	1800	0	200	1180000
1941	800	6200	318400	420000	358900	275200	275400	35900	10500	3800	1100	700	1706900
1942	1800	5500	332200	274200	418400	72400	158200	45700	12300	4000	1700	700	1327100
1943	1200	18100	114200	375800	103100	99100	45700	22200	8500	2100	1000	200	791200
1944	500	2000	7600	45900	108000	142000	19800	11800	3700	400	0	0	341700
1945	0	43500	88700	47400	216200	130800	45900	15000	4900	1400	0	0	593800
1946	12100	65500	449800	171500	61900	51200	33200	9300	2600	200	0	0	857300
1947	0	18900	36300	7000	91300	136800	39600	7400	3900	0	0	0	341200
1948	6800	7800	8400	77700	28600	108200	237000	62400	13200	4200	300	0	554600
1949	1600	1600	31700	31900	109800	364000	32500	9800	2100	0	0	0	585000
1950	200	0	2900	131100	176900	92200	49000	13900	3400	0	0	0	469600
1951	18000	103700	306600	294900	192900	91300	18500	31300	1600	400	0	0	1059200
1952	600	25200	376100	452800	233600	191900	37600	13500	2300	3200	100	200	1337100
1953	1100	3100	302300	542100	41000	99600	44400	29000	9300	0	0	400	1072300
1954	1600	28500	26400	286100	183000	150800	132500	20900	1200	800	1100	2300	835200
1955	2000	31100	107500	91400	31400	29300	59800	26300	1800	1200	0	0	381800
1956	3000	5600	541600	580600	393000	94700	22900	14300	4000	3100	500	100	1663400
1957	2200	7900	5200	63600	185200	171400	48800	71000	16300	1100	900	800	574400
1958	84000	29800	105900	248500	796800	268800	308900	24500	10100	4100	4000	300	1885700
1959	1900	1800	3200	185900	261100	38700	18400	3200	400	1500	300	700	517100
1960	1500	3000	2600	41100	295800	175900	36400	20400	1600	3000	2200	700	584200
TOTAL	194400	1024800	5423500	8855000	10458400	6728900	3939900	1177900	279400	75100	25600	15600	38198500
MEAN	3900	20500	108500	177100	209100	134600	78800	23600	5600	1500	500	300	764000
PERCENT	0.5	2.7	14.2	23.2	27.4	17.6	10.3	3.1	0.7	0.2	0.1	0.0	100.0

TABLE 92

RUNOFF OF RUSSIAN RIVER NEAR GUERNEVILLE

Location: Lat 38° 30' 00", Long, 122° 56' 05" in NE 1/4 Sec. 35, T8N, R10W, on left bank 0.6 mile downstream from Hobson Creek and 3.4 miles east of Guerneville.
Drainage area: 1,342 square miles.
Records available: October 1939 to date.
Recorded extremes: Maximum discharge 90,100 cfs (December 23, 1955); minimum discharge 61 cfs (July 4, 1950).
Remarks: Flow regulated by Coyote Reservoir beginning December 1958. (Usable capacity 118,000 acre-feet.) Flow since 1908 includes imported Eel River water. Numerous irrigational diversions are above this station, also since May 1959 further impairment to flow has been caused by the Wohler pumping plant.

Streamflow at this station was impaired during the 50-year study period by irrigation diversions; recorded flows were adjusted to correct for consumptive use of applied water. Adjustments were also made for regulation by Coyote Reservoir (December 1958 to September 1960), for imported Eel River water and for diversions by Wohler pumping plant.

Estimates of seasonal natural flows for 1910-11 through 1938-39 were obtained by a least squares correlation, utilizing data processing program No. 3020.80.1. Data from this correlation are:

$$\text{Log } Y = .0009\ X - 434.33$$

Y = seasonal full natural flow, Russian River near Guerneville

X = seasonal full natural flow, Eel River at Van Arsdale Dam near Potter Valley

$\bar{r}$ = correlation coefficient = 0.9800

$\bar{S}y$ = standard error of estimate = 171,060 acre-feet

TABLE 92 (Continued)

The monthly distribution of estimated seasonal flows was determined by the percent deviation method, using data processing program No. 3014.15.2. The gage on the Eel River at Van Arsdale Dam near Potter Valley was used as the base station.

Monthly and seasonal full natural flows at this station for the 50-year period 1910-11 through 1959-60 are tabulated on the following page.

TABLE 92 (CONTINUED)

RUNOFF OF RUSSIAN RIVER NEAR GUERNEVILLE

TYPE OF RECORD-UNIMPAIRED

INDEX NO. F91100
LOCATION LAT 38-30-00N, LONG 122-56-05W
NE1/4 SEC. 35, T8N, R10W, MDBM

SOURCE OF RECORD USGS
UNIT ACRE FEET
AREA 1342 SQ. MILES

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1911	1900	8200	35600	275800	234900	354000	177400	48800	22800	7500	3600	2900	1173400
1912	3700	5800	11400	164200	92700	158300	97300	118700	26900	10300	4700	11200	705200
1913	3600	67700	114200	376400	149800	97900	123300	35300	11900	7400	4700	1300	993500
1914	1600	23500	399800	1427500	609000	297600	134400	34000	15500	8100	3500	2500	2957000
1915	4800	4500	44900	349800	906200	319800	188500	130500	41300	14500	7600	2300	2014700
1916	2200	7900	195000	495800	581600	318700	73500	23400	8600	7000	4000	2300	1720000
1917	2100	6800	66700	91800	456600	180300	174500	47900	13700	5000	4200	2100	1051700
1918	2300	4500	41400	29500	190700	248200	101100	17800	4300	2700	2800	3200	648500
1919	2100	10100	22000	206800	435900	261900	96000	25500	5400	3100	2300	1700	1072800
1920	2900	4300	64100	21500	14100	121300	304700	30900	5800	3400	1800	1600	576400
1921	3000	204000	434400	503000	417600	220300	75300	26600	11700	4800	2500	1900	1905100
1922	800	6200	53600	46000	329400	163400	132900	46600	12900	7400	4000	1800	805000
1923	10700	25700	225900	184100	128000	51800	143600	17800	8000	4800	2900	2000	805300
1924	9500	25200	20900	87700	273700	32000	19900	10300	3900	3500	2900	1700	491200
1925	9100	37300	158800	92600	614300	111100	179000	74300	18200	6400	3900	1600	1306600
1926	4100	8500	27000	79400	428300	62500	122900	13700	3400	2400	1600	1200	755000
1927	3200	136800	271700	494500	1037000	259400	238000	42300	11100	5500	3100	1500	2504100
1928	4800	36800	59200	179100	217400	406200	172700	22000	5400	3700	2400	1100	1110800
1929	1600	25600	109900	72800	186800	77700	65700	22700	10900	6500	3900	1700	585800
1930	500	1300	234000	206400	192400	184200	66300	19000	4400	3000	1800	1000	914300
1931	1400	7500	11200	214100	93300	171400	32700	7600	4100	3200	2200	1500	550200
1932	2400	11800	293500	197100	102900	100500	51200	34600	6500	3000	1900	1100	806500
1933	500	5000	34500	76300	111200	304500	88000	56200	17500	8800	4600	2000	709100
1934	5100	4300	203400	147700	146500	100300	40600	12900	3000	2400	1800	1000	669000
1935	2600	52700	51800	233900	152700	215800	273800	33200	6400	3700	2500	1100	1030200
1936	2200	3100	25300	503400	500700	127700	87100	15700	12600	7100	3300	1500	1289700
1937	700	1800	7500	11300	213400	290800	181800	40700	12700	6700	3900	1500	772800
1938	5400	259600	813200	331000	1129000	1124700	341800	95500	25700	9900	6300	2400	4144500
1939	8700	19300	116400	95600	127200	183300	38200	14900	4300	3200	2200	1100	614400
1940	900	200	14100	451500	808400	461500	188600	29300	7600	3100	800	400	1966400
1941	2400	8300	599700	810700	619000	447000	507100	57300	16100	6900	2600	2000	3079100
1942	3000	7300	502200	467800	727100	132500	251900	66900	20200	8500	5000	2400	2194800
1943	2400	29300	170500	629400	169000	174500	69500	36100	13500	4300	3200	1600	1303300
1944	1900	3100	10800	73200	233100	246000	29200	16100	5800	2500	1500	600	623800
1945	200	55500	144300	75900	389400	205500	66900	23100	9900	4300	1700	1200	977900
1946	13100	91500	754500	275400	101900	76500	51500	13300	5700	3200	1600	1500	1389700
1947	1400	21600	59200	11300	144700	219800	65600	10900	7600	2700	1200	100	546100
1948	11800	11400	11600	123800	36400	156800	394400	108400	19800	8400	2600	1500	886900
1949	3300	1300	40700	51500	159300	628000	51300	14700	6500	2400	2700	1400	963100
1950	2200	600	10800	230900	351400	132100	69600	17300	6500	1500	1900	600	825400
1951	28300	170400	543100	458900	289900	136100	29600	47700	7400	5100	3200	2700	1722400
1952	1600	37200	629300	803600	367500	311600	61000	21200	5500	8500	2900	3000	2252900
1953	3900	3400	509200	823400	56300	140700	73000	45500	14200	4400	3500	4000	1681500
1954	3600	40100	33100	427900	300200	253300	218300	33600	10000	5700	1300	4000	1331100
1955	4700	56500	186000	150300	50200	41100	96300	40000	6600	7100	3700	2000	644500
1956	4400	5100	1062600	1006400	657300	144200	41600	29800	13200	9800	6000	4500	2984900
1957	1000	11000	5800	86200	303500	263900	75000	109400	23400	7400	5600	700	892900
1958	104900	39400	173600	384900	1430200	504600	571300	36900	17400	11000	9000	4900	3288100
1959	6100	5200	4800	311700	454900	58600	23900	8700	5300	8300	5700	2900	896100
1960	5600	7600	5700	70500	532800	289700	47800	22600	9100	9400	7100	5200	1013100
TOTAL	310200	1621800	9618900	14920300	18255800	11569600	6805600	1908200	570200	289500	169700	107000	66146800
MEAN	6200	32400	192400	298400	365100	231400	136100	38200	11400	5800	3400	2100	1322900
PERCENT	0.5	2.4	14.5	22.6	27.5	17.5	10.3	2.9	0.9	0.4	0.3	0.2	100.0

TABLE 93

ESTIMATED MEAN MONTHLY DISTRIBUTION OF NATURAL RUNOFF
FROM RUSSIAN RIVER HYDROGRAPHIC UNIT

50-YEAR MEAN PERIOD, 1910-60

Subunit and related gaging stations		October		November		December		January		February		March		April		May		June		July		August		September		Total
Ref. No.	Name	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Per-cent	Acre-feet	Acre-feet
F-9A	Coyote Valley	0.6	500	2.3	1,900	15.1	12,200	28.3	22,900	30.7	24,900	15.0	12,100	7.4	6,000	0.4	300	0.2	200	0.0	—	0.0	—	0.0	—	81,000
F-9 4100	East Fork Russian River near Ukiah (gage)	0.6	500	2.3	1,900	15.1	12,200	28.3	22,900	30.7	24,900	15.0	12,100	7.4	6,000	0.4	300	0.2	200	0.0	—	0.0	—	0.0	—	81,000
F-9B	Forsythe Creek	0.6	700	2.5	2,900	15.7	17,900	25.3	28,900	26.9	30,800	15.8	18,000	9.7	11,100	2.4	2,800	0.7	800	0.2	200	0.1	100	0.1	100	114,300
F-9 1850	Russian River near Ukiah (gage)	0.6	700	2.5	2,900	15.7	17,900	25.3	28,900	26.9	30,800	15.8	18,000	9.7	11,100	2.4	2,800	0.7	800	0.2	200	0.1	100	0.1	100	114,300
F-9C	Upper Russian River	0.4	1,000	2.0	5,000	13.8	35,200	23.8	60,900	26.4	67,600	18.2	46,600	11.7	29,900	3.3	8,500	0.3	700	0.0	—	0.1	200	0.0	100	255,700
F-9 1680	Russian River near Cloverdale (gage)		2,200		9,800		65,300		112,700		123,300		76,700		47,000		11,600		1,700		200		300		200	451,000
	Subtotal: (All preceding hydrographic units)		2,200		9,800		65,300		112,700		123,300		76,700		47,000		11,600		1,700		200		300		200	451,000
F-9D	Sulphur Creek	0.5	500	3.4	3,400	13.8	13,700	20.6	20,400	27.4	27,200	18.6	18,400	10.2	10,100	3.8	3,800	1.2	1,200	0.4	400	0.1	100	0.0	0	99,200
F-9E	Middle Russian River	0.6	1,200	3.4	7,300	13.8	29,500	20.6	44,000	27.5	58,700	18.5	39,500	10.1	21,700	3.8	8,100	0.8	2,700	0.4	900	0.0	100	0.0	100	213,800
	Subtotal: (All preceding hydrographic units)		3,900		20,500		108,500		177,100		209,200		134,600		78,800		23,500		5,600		1,500		500		300	764,000
F-9 1500	Russian River near Healdsburg (gage)		3,900		20,500		108,500		177,100		209,200		134,600		78,800		23,500		5,600		1,500		500		300	764,000
F-9F	Santa Rosa Creek	0.3	200	1.5	1,000	14.8	9,900	21.0	14,000	28.2	18,900	17.3	11,600	10.8	7,200	2.4	1,600	1.2	800	1.2	800	0.8	600	0.5	300	66,900
F-9G	Laguna Creek	0.3	200	1.5	1,100	14.8	10,800	21.0	15,300	28.2	20,600	17.3	12,600	10.8	7,800	2.4	1,700	1.2	900	1.2	900	0.8	600	0.5	400	72,900
F-9H	Mark West	0.3	300	1.5	1,300	14.8	12,700	21.0	18,000	28.2	24,200	17.3	14,800	10.8	9,200	2.4	2,000	1.2	1,000	1.2	1,000	0.8	700	0.5	400	85,600
F-9J	Dry Creek	0.6	1,400	2.9	7,200	15.3	38,300	22.6	56,600	27.4	68,700	17.4	43,400	9.6	24,100	2.9	7,400	0.8	2,100	0.3	600	0.1	300	0.1	200	250,300
	Subtotal: (All preceding hydrographic units)		6,000		31,100		180,200		281,000		341,600		217,000		127,100		36,200		10,400		4,800		2,700		1,600	1,239,700
F-9 1100	Russian River near Guerneville (gage)		6,200		32,400		192,400		298,400		365,100		231,400		136,100		38,200		11,400		5,800		3,400		2,100	1,322,900
F-9K	Austin Creek	0.3	300	1.5	1,600	14.8	15,900	21.0	22,500	28.2	30,400	17.3	18,600	10.8	11,600	2.4	2,500	1.2	1,300	1.2	1,300	0.8	900	0.5	600	107,500
F-9L	Lower Russian River	0.3	500	1.5	2,500	14.8	24,100	21.0	34,100	28.2	46,000	17.3	28,200	10.8	17,500	2.4	3,800	1.2	2,000	1.2	2,000	0.8	1,400	0.5	800	162,900
	Subtotal: (Entire Russian River Watershed)		6,800		35,200		220,200		337,600		418,000		263,800		156,200		42,500		13,700		8,100		5,000		3,000	1,510,100
F-9M	Bodega	0.3	300	1.5	1,700	14.8	16,800	21.0	23,900	28.2	32,200	17.3	19,700	10.8	12,200	2.4	2,700	1.2	1,400	1.2	1,400	0.8	1,000	0.5	300	113,600
F-9N	Walker Creek	0.3	200	1.5	1,000	14.8	9,600	21.0	13,700	28.2	18,400	17.3	11,300	10.8	7,000	2.4	1,500	1.2	800	1.2	800	0.8	600	0.5	300	65,200
	Total Russian River Hydrographic Unit	0.4	7,300	2.2	37,900	14.6	246,600	22.2	375,200	27.7	468,600	17.4	294,800	10.4	175,400	2.8	46,700	0.9	15,900	0.6	10,300	0.5	6,600	0.3	3,600	1,688,900

Ground Water Hydrology

Areal Geologic Conditions

The Russian River drainage basin is situated in the large and geologically complex North Coast Ranges. These ranges and their valleys are structurally controlled by folding and faulting. The oldest rocks are Jurassic and Cretaceous in age. They consist of consolidated sedimentary, metamorphic, and igneous rocks which are generally fractured and sheared. These consolidated rocks are considered to be essentially nonwater-bearing, although minor quantities of water occur where deep weathering, fracturing, shearing, or jointing have created secondary permeability. These rocks underlie the water-bearing deposits at depth and generally form the boundaries of ground water basins.

The oldest water-bearing units are Pliocene and Pleistocene in age. They include the marine Merced Formation, the continental Glen Ellen Formation, and dissected, uplifted, undifferentiated continental deposits. Although sometimes of limited areal extent and low permeability, these water-bearing units are important sources of ground water locally, for domestic and stockwatering purposes. To some extent, they also act as forebay or recharge areas for overlying and adjacent younger, more prolific water-bearing deposits. Recent alluvium is the principal ground water producing unit in the area of investigation. It includes materials deposited on alluvial fans, in the flood plains of streams, and in the river channels.

The following ground water basins and subbasins are included within the area of investigation and are discussed in more detail in the following sections; from the northernmost basin southward, they are:

Potter Valley Ground Water Basin
Ukiah Valley Ground Water Basin
Sanel Valley Ground Water Basin
McDowell Valley Ground Water Basin
Cloverdale Valley Ground Water Basin
Alexander Valley Ground Water Basin
Knights Valley Ground Water Basin
  North Basin
  South Basin

Santa Rosa Valley Ground Water Basin
    Healdsburg Area
    Santa Rosa Area
Rincon-Kenwood Ground Water Basin
    Rincon Valley
    North Kenwood Valley
Lower Russian River Valley Ground Water Basin
    (below Rio Dell)

The geologic conditions, and nature and occurrence of ground water, in the coastal area south of the Russian River are not discussed by ground water basin, but are described separately for the Bodega and Walker Creek subunits of the Russian River Hydrographic Unit.

Potter Valley Ground Water Basin

Potter Valley ground water basin, the northernmost basin in the Russian River area, is situated approximately 11 miles northeast of Ukiah. It is approximately 7 miles in length, varies from about $1\frac{1}{2}$ miles to 2 miles in width, and encompasses an area of approximately 13 square miles.

Geologic Conditions. The basin is situated in a depression that is structurally controlled by folding and faulting. Nonwater-bearing consolidated rocks form the boundaries of the ground water basin and underlie the water-bearing materials at depth. Water-bearing deposits include uplifted, undifferentiated, Tertiary and Quaternary continental sediments of low permeability which are discontinuously exposed along the margins of the basin, and Recent alluvial deposits which form the valley floor area. The continental deposits underlie the alluvium to some extent beneath the valley and directly overlie nonwater-bearing consolidated rocks.

The uplifted, older continental deposits consist principally of sandy silt and clay with some gravel and sand. Cementation, compaction, and the abundance of fine-grained materials result in these deposits having low permeabilities. The Recent alluvium also consists principally of clay and silt with thin lenses of sand and gravel. Although more permeable than the underlying continental deposits, the abundance of fine-grained materials and the thin, poorly connected lenses of sand and gravel result in this unit also being of moderately low permeability. Yield to wells penetrating alluvium varies from 50 to 75 gpm with specific capacities of from 1 to 5 gpm per foot of drawdown. Maximum thickness of the older continental deposits is probably several hundred feet and that of the alluvium about 60 feet.

Occurrence and Nature of Ground Water. The undifferentiated continental deposits exposed along the flanks of the ground water basin locally yield minor quantities of water for domestic and stockwatering purposes and probably, to some extent, act as recharge areas for the younger Recent alluvial deposits overlying them in Potter Valley. The Recent alluvium, however, is the principal water-producing unit. There are limited data regarding the occurrence of ground water in the continental deposits; however, it is probably largely confined. Ground water in the alluvium is also confined except at shallow depths and near the apex of alluvial fans on the valley's margin. Ground water moves from the recharge areas along the valley margins toward the river in the central part of Potter Valley. Recharge is by infiltration and percolation of precipitation and streamflow, and by infiltration of unconsumed irrigation water in Potter Valley.

Use of ground water for irrigation purposes is limited; however, domestic and stockwatering supplies are generally obtained from ground water.

As shown in Table 94 at the end of this section, the usable ground water storage capacity of the Potter Valley ground water basin is estimated to be 9,000 acre-feet. Approximately 60,000 acre-feet of storage are in the older continental deposits; however, this storage is probably not usable for short-term cyclic storage because of the low permeability of the sediments.

Ukiah Valley Ground Water Basin

Ukiah Valley ground water basin is the northernmost basin along the Russian River proper. It is approximately 22 miles in length, averages 3 miles in width, and underlies an area of approximately 61 square miles.

TABLE 94

USABLE GROUND WATER STORAGE CAPACITY
RUSSIAN RIVER HYDROGRAPHIC UNIT

Ground water basin	Water-bearing unit	Average specific yield (percent)	Depth zone (feet)	Area (acres)	Usable Storage Capacity (acre-feet)
otter Valley	Alluvium	5	10-50	4,500	9,000
kiah Valley	Alluvium	20	10-50	4,500	35,000
anel Valley	Alluvium	20	10-50	2,500	20,000
loverdale Valley	Alluvium	20	10-35	3,000	15,000
lexander Valley	Alluvium	20	10-50	7,500	60,000
nights Valley (2 basins)	Alluvium	6	10-100	2,800	17,000
ower Russian River below Rio Dell	Alluvium	15	10-50	3,700	22,000
enwood-Rincon	Alluvium	5.5	10-200	4,300	45,000
anta Rosa Valley					
Santa Rosa Area	Alluvium and underlying Glen Ellen formation	7.8	10-200	64,000	950,000
Healdsburg Area	Alluvium	14.5	10-50	11,500	67,000
odega and Walker Creek Subunits	Alluvium	12	10-30	9,400	23,000
	Terraces	9	10-30	1,000	1,800
			Total (rounded)		1,250,000

Geologic Conditions. The basin is situated in a depression caused by faulting and folding. Nonwater-bearing consolidated rocks form the boundaries of the ground water basin and underlie the water-bearing materials at depth. Water-bearing deposits in the basin include uplifted, undifferentiated Tertiary-Quaternary continental sediments of low permeability which are discontinuously exposed along the basin margins, and Recent alluvial sediments in the relatively flat floor of the valley. The alluvium is underlain in part by the Tertiary-Quaternary continental deposits, and in part by consolidated rocks.

The undifferentiated continental deposits consist principally of semiconsolidated, poorly sorted deposits of clayey and sandy gravel, clayey sand, and sandy clay. Cementation, compaction, and the abundance of fine-grained materials in these deposits cause them to be of low permeability. Most wells in this material yield less than 50 gpm, and specific capacities are less than 1 gpm per foot of drawdown.

The overlying Recent alluvium consists of unconsolidated deposits of gravel, sand, and silt with some clay. The alluvium is relatively permeable and is the most important ground water-producing unit in the basin. Wells producing from it yield up to 1,200 gpm with specific capacities generally varying from 0.5 to 7 gpm per foot of drawdown. Locally, specific capacities may exceed 100 gpm per foot of drawdown.

Thickness of the undifferentiated continental deposits is variable; however, the maximum thickness is probably about 2,000 feet. Maximum thickness of the Recent alluvium is probably about 80 feet.

Occurrence and Nature of Ground Water. Undifferentiated older continental deposits exposed along the flanks of the ground water basin locally yield minor quantities of water for domestic and stockwatering purposes. These continental deposits also act as recharge areas for the more prolific water-producing Recent alluvial deposits.

There are limited data regarding the occurrence of ground water in the older continental deposits; however, it is probably locally confined. Ground water in the Recent alluvium is essentially unconfined. Depth to ground water in the continental deposits on the margins of the basin varies from near the ground surface to over 60 feet, while depth to water in the alluvium of the valley floor ranges from a few feet to 20 feet. The general ground water movement is in the direction of the topographic slope toward the Russian River and then southward down the valley. Recharge is by infiltration and percolation of rainfall and streamflow in recharge areas along the margins of the basin, and by deep percolation of unconsumed irrigation water in the valley floor areas. Some recharge to the water-bearing deposits occurs by ground water movement from fractures, shears, etc., in the underlying and adjacent consolidated bedrock surrounding the basin.

Ground water is used extensively in the Ukiah Valley ground water basin for irrigation, domestic, and industrial purposes. An estimated 10,000 acre-feet of ground water was used in 1954. Mineral quality of ground water is generally good. Water in the undifferentiated continental deposits generally contains more dissolved solids than that in the Recent alluvial deposits.

As shown in Table 94 at the end of this section, the usable ground water storage capacity of the Ukiah Valley ground water basin is estimated to be about 45,000 acre-feet. About 324,000 acre-feet of storage exists in the older continental deposits; however, this is probably not usable for short-term cyclic storage because of the low permeability of the sediments.

Sanel Valley and McDowell Valley Ground Water Basins

Sanel Valley ground water basin is located along the Russian River approximately 12 miles south of Ukiah. It is about 8 miles long, has a maximum width of about 6 miles, and includes an area of approximately 9 square miles. McDowell Valley ground water basin, located immediately east of Sanel Valley, is about 3 miles long and 1.5 miles wide. It includes an area of about 2 square miles. Although the ground waters of these two basins are not in hydraulic connection, they are discussed together because of their proximity and similarity of geologic conditions.

Geologic Conditions. Sanel Valley, and probably McDowell Valley, ground water basins occupy depressions that are structurally controlled by folding and faulting. Consolidated nonwater-bearing rocks form the boundaries of the ground water basins and underlie the water-bearing deposits at depth. Water-bearing deposits include uplifted, undifferentiated Tertiary-Quaternary continental sediments of low permeability, and Recent alluvium of relatively high permeability. The older continental deposits are exposed east and southeast of Hopland in the Sanel Valley ground water basin and in all of McDowell Valley. Recent alluvium underlies the floor of Sanel Valley and, in turn, is probably underlain extensively by the older continental deposits.

The undifferentiated continental deposits consist of compacted silty and clayey gravel and silty clay. Cementation, compaction, and the prevalence of fine-grained materials cause these deposits to be of low permeability. Yields as low as 7 gpm and specific capacities of less than 1 gpm per foot of drawdown are common.

The alluvium overlying the continental deposits is mostly coarse sand and gravel overlain by a thin layer of silt, silty clay, or sandy clay. Except for the fine-grained layer, the alluvium has a relatively high permeability. Wells pumping from the alluvium yield from 500 to 1,200 gpm, and specific capacities range from 20 to more than 100 gpm per foot of drawdown.

There are little data regarding the maximum thickness of the continental deposits; however, they are estimated to be several thousand feet thick. Thickness of the Recent alluvium is very irregular, and its maximum thickness is probably about 50 feet.

<u>Occurrence and Nature of Ground Water</u>. Ground water in the Pliocene and Pleistocene continental deposits of Sanel and McDowell ground water basins is generally confined. Water in the overlying Recent alluvium is unconfined. The ground water reservoir is

recharged principally by direct infiltration of rainfall and streamflow on the alluvium and on the exposed permeable portions of the continental deposits. Water moves into the alluvium from the adjacent and underlying continental deposits and consolidated bedrock. The general direction of ground water movement is toward the center of the ground water basins from the margins. When river stages are highest in the winter, water moves from the Russian River into the Sanel Valley alluvium.

The principal use of ground water in these basins is for irrigation, and approximately half of the applied irrigation water is pumped from ground water.

As shown in Table 94 at the end of this section, the usable ground water storage capacity of Sanel Valley ground water basin is estimated to be approximately 20,000 acre-feet. Capacity of the older continental deposits in McDowell and Sanel Vallies ground water basins is about 27,000 acre-feet. The storage in these older sediments is probably not usable because of low permeability.

Cloverdale Valley Ground Water Basin

Cloverdale Valley ground water basin is situated along the Russian River in Sonoma County immediately south of the Mendocino County line approximately 10 miles south of Sanel Valley. It is a narrow valley, approximately 6 miles long, and encompasses an area of approximately 8 square miles.

Geologic Conditions. The basin occupies a fault-complicated structural trough. Nonwater-bearing consolidated rocks underlie water-bearing sediments at depth and form the boundaries of the basin, except on the south, where a narrow section of alluvium connects it with Alexander Valley ground water basin to the south. Water-bearing materials overlying the consolidated rock include uplifted dissected

Pleistocene continental deposits of relatively low permeability on the western margins of the basin, and permeable Recent alluvium which forms the floor of Cloverdale Valley. The alluvium is partially underlain by the older continental deposits and partially by bedrock.

The continental sediments are composed of gravel, sand, silt, and clay which have been considerably weathered and compacted or cemented, thus causing a low permeability. They are estimated to be over 100 feet thick. Recent alluvium consists principally of sand and gravel and is highly permeable. It has a maximum thickness of about 40 feet. Wells in alluvium yield up to 1,000 gpm with 8 feet of drawdown, and specific capacities up to 250 gpm per foot of drawdown have been recorded.

Occurrence and Nature of Ground Water. The continental deposits exposed along the flanks of the ground water basin locally are a source of ground water; however, their yield to wells is low. These deposits probably serve, to some extent, as forebay areas for the adjacent younger Recent alluvium. The alluvium is the main ground water producing unit in the basin. Ground water in the Pleistocene continental deposits is probably partially confined, while that in the alluvium is generally unconfined. Depth to water varies from 5 to 25 feet below ground. Ground water movement is toward the center of the valley from recharge areas on the basin margins and then southward. Recharge is by infiltration and percolation of precipitation and streamflow in permeable areas. The Russian River locally provides recharge when at high stage.

Ground water is used principally for irrigation purposes, although there is an increasing industrial use. Domestic and stock-watering use is relatively small.

As shown in Table 94 at the end of this section, the usable ground water storage capacity of Cloverdale Valley ground water basin is estimated to be 15,000 acre-feet. Capacity of the continental deposits is about 5,000 acre-feet; however, it probably is not usable for short-term cyclic storage.

Alexander Valley Ground Water Basin and Knights Valley Ground Water Basin

Alexander Valley ground water basin is situated along the Russian River immediately south of Cloverdale Valley and about 5 miles east of Healdsburg. It is a narrow valley, approximately 14 miles in length, and includes an area of approximately 33 square miles. Knights Valley ground water basin, situated about 3 miles southeast of Alexander Valley, includes two alluviated areas separated by a narrow strip of nonwater-bearing consolidated rock. Although these two areas may be considered as two ground water basins, they are discussed as one area in this report, and the ground water reservoir capacity is computed accordingly. They include total area of approximately 4-1/2 square miles.

Geologic Conditions. Alexander Valley ground water basin and the Knights Valley basin are situated in faulted synclinal structures that have the same northwesterly trend as Cloverdale Valley to the north. Alexander Valley and Cloverdale Valley ground water basins have limited hydraulic continutiy through a narrow gorge filled with alluvium. With the exception of this channel, the ground water basins are bounded and underlain by nonwater-bearing rocks of Jurassic, Cretaceous, and Tertiary age. An unnamed Cretaceous conglomerate in the rolling upland area between Alexander and Dry Creek Valleys and the Sonoma volcanics of Pliocene age yield sufficient quantities of water to maintain domestic and stockwatering wells. Because of the topographic location, structure, and unknown physical characteristics of the conglomerate, and the limited areal extent and unknown physical characteristics of the volcanics, they have not been included within the ground water basin boundaries, and are included with nonwater-bearing rocks in this report.

Water-bearing deposits in Alexander Valley ground water basin include the Tertiary-Quaternary Glen Ellen Formation, uplifted Pleistocene continental terrace deposits, and Recent alluvium. The continental terrace deposits are discontinuous deposits of very limited areal extent and are only of localized importance as water-producing units.

The Glen Ellen Formation underlies alluvium in the southern half of Alexander Valley and perhaps part of the northern half. The Glen Ellen Formation consists of poorly sorted, lenticular deposits of gravel, sand, silt, and clay which grad laterally and vertically into one another. It probably has a maximum thickness of several thousand feet. Permeability of this formation is only moderate due to the abundance of fine-grained materials, the poor sorting, and the heterogenous nature of the deposits. Wells in this material yield up to 400 gpm, and specific capacities from 3 to 8 gpm per foot of drawdown have been reported. The Recent alluvium, in general, is more permeable. It consists principally of layers and lenses of unconsolidated gravel, sand, silt, and clay, and probably has a maximum thickness of 60 feet. The materials closest to the Russian River are the most permeable. Shallow wells 25 to 50 feet deep near the river yield from 200 to 500 gpm with specific capacities of 10 to 100 gpm per foot of drawdown. Further from the river, permeabilities decrease and yields to wells are less than 200 gpm. Specific capacities are from 2 to 5 gpm per foot of drawdown.

In the Knights Valley ground water basin, Recent alluvium is the only water-bearing unit mapped. There are no well data available to indicate the thickness or water-bearing properties of the alluvium in this area.

Occurrence and Nature of Ground Water. The alluvium is the principal ground water-producing unit in the Alexander Valley ground water basin. The Glen Ellen Formation yields substantial quantities of water to deep wells, however, and acts as a forebay for the alluvium in the valley. Ground water in the Glen Ellen Formation is at least partially confined except in the recharge areas. Water in the alluvium is probably unconfined. There are little data regarding ground water depth or movement in the Glen Ellen Formation, although the water probably moves toward the center of Alexander Valley and then into the overlying or adjacent alluvium. Depth to water in the alluvium is generally from 5 to 15 feet below ground surface, depending in part on the slope of the ground and the transmissibility of the materials. Ground water movement is generally from recharge areas along the margins of the valley toward the center and then southwestward. Recharge to ground water is principally from infiltration and percolation of rainfall and streamflow in recharge areas in the margins of the valley. Subsurface movement of water also occurs to some extent from the nonwater-bearing rocks bordering the valley into the water-bearing deposits. The Russian River also provides some local recharge to alluvium during high stages.

The primary use of ground water in the Alexander Valley ground water basin is for irrigation. In addition, it is used for domestic and stockwatering purposes. An estimated 3,000 acre-feet of ground water were pumped in 1954.

As shown in Table 94 at the end of this section, usable ground water storage capacity of the Alexander Valley ground water basin has been estimated to be 60,000 acre-feet. Capacity of the uplifted continental deposits is about 160,000 acre-feet, but it probably is not usable for short-term cyclic storage.

Ground water in the Knights Valley ground water basin is probably unconfined in the Recent alluvial deposits. Depth to water is unknown. Ground water movement is probably toward the streams in the central portion of the alluviated areas and then in a downstream direction.

Although there are no well data regarding the physical characteristics of the alluvial deposits or their thickness in the Knights Valley area, a ground water reservoir capacity has been estimated by comparing this area with the Calistoga area of the Napa Valley to the southeast. The estimated reservoir capacity of Knights Valley area as shown in Table 94 is 17,000 acre-feet.

Santa Rosa Valley, Kenwood-Rincon and Lower Russian River Valley Ground Water Basins

The area of water-bearing sediments in valleys between the Pacific Ocean and Alexander Valley is approximately 210 square miles. The area extends from approximately 11 miles north of Healdsburg, southward along Dry Creek to a topographic divide about 1 mile south of the City of Cotati. Its easternmost boundary is along the Napa-Sonoma County line south of Knights Valley and its westernmost limit the Pacific Ocean at the end of the narrow canyon of the lower Russian River Valley.

The larger valleys situated within the area are Dry Creek Valley, Santa Rosa Valley, Bennett Valley, Rincon Valley, and a portion of both Cotati Plain and Kenwood Valley.

Although several of the valleys included in this area are separate ground water basins, they are not discussed separately in this report, in order to simplify discussion of the area. Ground water reservoir capacity, however, was estimated separately for each valley area.

Geologic Conditions. Valleys in this area are structurally controlled. Santa Rosa, Dry Creek, Rincon, and Kenwood Valleys all follow faulted synclines or downfolds with a northwesterly trend. The lower portion of the Russian River, however, cuts across the trend of geologic structure west of Rio Dell on its way to the Pacific Ocean.

Consolidated, essentially nonwater-bearing rocks form the boundaries of the area and underlie water-bearing deposits at depth. The Pliocene Sonoma volcanics locally yield sufficient quantities of water for domestic and stockwatering wells, and in some areas of extreme fracturing, wells yield large quantities of ground water under artesian pressures. Due to the heterogeneity of these volcanics, their topographic position, and their unknown physical characteristics, they are not considered for use and storage as water-bearing rocks for the purpose of this investigation.

Water-bearing deposits include the Tertiary-Quaternary Merced and Glen Ellen Formations, Pleistocene continental terrace deposits, and Recent alluvium. The marine Merced Formation is exposed in the low hills on the western side of Santa Rosa Valley. The Glen Ellen Formation crops out in the central and eastern parts of Santa Rosa Valley, along the eastern border of Dry Creek Valley, and adjacent to Bennett, Kenwood and Rincon Valleys. These two formations, composed of poorly sorted and partially consolidated sand, silt, and clay, have a moderately low permeability. The Merced Formation, with an estimated thickness of approximately 1,500 feet, and the Glen Ellen Formation, with a thickness of about 3,000 feet, probably interfinger at depth beneath the Santa Rosa Valley. Continental terrace deposits, also of moderate permeability, are exposed principally as discontinuous deposits bordering Dry Creek Valley. They are also poorly sorted and consist of gravel, sand, silt, and clay. With a maximum estimated thickness of 200 feet, these deposits overlie the Glen Ellen Formation and underlie Recent alluvium. The alluvium which underlies the floor of the valleys is the most permeable water-bearing unit in the area. It consists of lenses of sand and gravel and unconsolidated silt and clay, and has a maximum thickness of approximately 150 feet.

Occurrence and Nature of Ground Water. Although the Merced and Glen Ellen Formations are only moderately permeable, they form the principal ground water reservoir in the area of investigation. Water encountered in these deposits is mostly confined. Deep wells produce substantial quantities of water. Maximum yield to wells is about 550 gpm, with the average being much less; and specific capacities range from 5 to 10 gpm per foot of drawdown. The continental terrace deposits are also only moderately permeable due to their poor sorting and partial consolidation and they also contain water under confined conditions. Reported yield to wells is from about 10 to 200 gpm, with specific capacities of about 7 gpm per foot of drawdown. The alluvium along the Russian River is a permeable and productive water-bearing deposit. It contains water that is essentially unconfined, although local confinement may occur. Wells yield over 500 gpm, with specific capacities from 75 to 200 gpm per foot of drawdown.

Depth to ground water is partially governed by the topography, and by the transmissibility of the underlying sediments. Depths to water in the relatively flat valley floor areas are generally from 5 to 20 feet below ground surface. In the upland areas, depth to water is much greater. Ground water recharge is by infiltration of rainfall and streamflow in areas underlain by permeable deposits. Subsurface movement of water from the Merced and Glen Ellen Formations and the continental terrace deposits provides recharge for the overlying and adjacent alluvium. In addition, the water-bearing deposits receive some recharge from springs in the nonwater-bearing rocks.

Underflow from Dry Creek moves southeastward into the alluvium of the Russian River Valley. Water in Santa Rosa Valley moves generally from the east, south, and west, toward Laguna de Santa Rosa, where large quantities of water are discharged by evapotranspiration. Also, subsurface movement of water from Santa Rosa Valley into the Russian River Valley occurs through the Glen Ellen Formation several miles northeast of Rio Dell. Subsurface movement of water occurs from the northern part of Kenwood Valley into Rincon Valley, and subsequently into Bennett Valley and then Santa Rosa Valley.

Substantial quantities of ground water are used in the Healdsburg-Santa Rosa area. In the Lower Russian River Valley below Rio Dell, however, there is little use of ground water except for domestic purposes.

In the lower reach of the Russian River below Duncans Mills, wells near the river have high sodium and chloride content. These wells apparently are recharged by brackish water from the tidal reach of the river. This area was considered to have no usable storage capacity because of the water quality. The reach from Duncans Mills to Monte Rio was included in the basin, although it may be intruded by sea water in the future if heavy ground water pumping occurs or the flow of the river is reduced.

The combined usable ground water storage capacity of the Santa Rosa-Healdsburg, lower Russian River Valley, and Kenwood-Rincon areas is approximately 1,100,000 acre-feet. The separate amounts are shown on Table 94 at the end of this section. There is an additional storage capacity of about 540,000 acre-feet in the older sediments adjacent to and underlying the alluvium in these areas; however, it probably is not usable for short-term cyclic storage because of the low permeability of the sediments.

Bodega and Walker Creek Subunits

All the coastal drainages from the Russian River to the south end of Tomales Bay are included in this area. The most southern of the small drainages is called Grand Canyon. The largest streams are Salmon Creek, Estero Americano, Estero San Antonio, and Walker Creeks. The towns of Salmon Creek, Bodega Bay, Bodega, Freestone, Valley Ford, Bloomfield, Dillon Beach, and Tomales are in this watershed.

Geologic Conditions. The nonwater-bearing bedrock of the area consists of sandstone, shale, greenstone, and schist of the Franciscan Formation and a small area of granite at Bodega Head. Overlying the bedrock is a Pliocene marine formation, the semiconsolidated Merced sandstone, which is up to 1,000 feet thick. This formation underlies about 34 percent of the drainage area. Marine terraces are present along the coast, and alluvium is present in the valleys. Post-Merced northwest trending block faulting has resulted in several small tilted blocks and a dropped block, or graben, in the vicinity of Bloomfield.

Occurrence and Nature of Ground Water. Ground water is found in the alluvium, the terraces, and in the Merced Formation. Information on the ground water in this area is scarce. For this investigation, 18 well logs were field checked. A short discussion of ground water problems is contained in the California Division of Mines Bulletin No. 162, "Geology of the Sebastopol Quadrangle," in which it is stated that this area:

> "... is covered by Merced formation, but the formation does not contain the abundant supplies of water found elsewhere. Although water is more easily obtained here than in areas of Franciscan-Knoxville rocks, the need for larger amounts for dairies, ranches, and farms emphasizes the limited quantities. Most wells for domestic use in this area are sunk in the valley alluvium and are about 25 feet deep. Springs are not uncommon due to the alternation of pervious with impervious, nearly horizontal beds, and many residents develop these, especially for stock use. Other wells for domestic use are commonly 200 to 300 feet deep. Northeast of Two Rock, the Merced formation includes small lenses of gravel and coarse sand which are excellent aquifers, especially where they rest on basalt flows or Franciscan-Knoxville rocks."

Wells penetrating the Merced Formation on ridges in the vicinity of Occidental had reported yields of 1/4 gpm to 25 gpm. Specific capacities were all less than 1 gpm per foot of drawdown. The tests reported by the drillers are assumed to be bailer tests and are not necessarily very accurate.

Estimated ground water reservoir capacities for the water-bearing units in the Bodega and Walker Creek Subunits are presented in Table 94. There are limited data available regarding the Merced Formation, and further study of the physical characteristics is needed.

Cost of Pumping Ground Water

The only area where large well yields may be obtained at shallow pumping levels is in the alluvium along the Russian River. In the rest of the area, less permeable water-bearing sediments

TABLE 95

DESCRIPTION OF WELLS USED TO ESTIMATE PUMPING COSTS

Well characteristics	Russian River alluvium	Older sediments in all valleys and alluvium in Potter Valley and Santa Rosa area
Depth	70 feet	200 feet
Casing diameter	14 inches	12 inches
Head		
Pumping level	25 feet	100 feet
Surcharge for sprinklers	115 feet	115 feet
Total	140 feet	215 feet
Yield	1,000 gpm	500 gpm
H. P. Motor	60	50
Efficiency	60%	60%

TABLE 96

APPROXIMATE COST OF PUMPING GROUND WATER
(In Dollars per Acre-Foot)

Use factor (percent)	Pumping from Russian River alluvium	Pumping from older sediments in all valleys and from alluvium in Potter Valley and Santa Rosa area
10	$7.00	$16.30
15	5.80	12.40
20	4.95	10.20
25	4.30	8.80
30	3.90	7.80
35	3.60	7.25

exist and deeper pumping levels are dictated by greater initial depths to water and/or larger drawdowns. A hypothetical well having average characteristics for wells in each of these two areas was used to compute pumping cost at various use factors. These costs, shown in Table 96, are based on present water levels, equipment costs, and power schedules, and were determined by the procedure outlined on page 50.

The left column of Table 96 applies to more permeable deposits such as the alluvium mapped along Dry Creek and along the course of the Russian River, excluding that in Potter Valley. Thickness of this material averages 50 feet in the northern ground water basins and reaches a maximum thickness of 200 feet in the lower Russian River Valley near the coast. The right column applies to less permeable deposits such as the alluvium of Potter Valley, Santa Rosa Valley area of the Santa Rosa Valley ground water basin, and the Kenwood-Rincon basin and to the older sediments underlying the Recent alluvium in all of the Russian River Valley ground water basins. Older sediments in upland areas adjacent to the alluvial deposits of the valleys may be as permeable as those underlying the alluvium; however, there are no data to substantiate this.

Pumping costs were computed from wells having characteristics shown in Table 95.

Water Quality

Ground and surface water quality data are available for most of the subunits of the Russian River Hydrographic Unit. These data are summarized in Table 97. This summary characterizes surface waters of the hydrographic unit as soft and generally of a calcium-magnesium bicarbonate type, containing low concentrations of total dissolved minerals and moderate concentrations of boron. Ground waters throughout this hydrographic unit are about four times more mineralized than surface waters. These ground waters are moderately hard and are nearly of the same mineral types as their associated surface waters, while containing moderate concentrations of total dissolved minerals along with high concentrations of boron.

With the exception of their boron contents, surface and ground waters of the hydrographic unit are usually of an excellent mineral quality. However, moderate to high concentrations of boron do constitute water quality problems when considering the use of these waters for some agricultural purposes. As can be seen in Table 97, very high concentrations of boron occur in only a few of these subunits. These localized occurrences of very high boron concentrations constitute a potential water quality problem of greater magnitude than those presently existing. As with other hydrographic units in the study area, effect of future water project development will be paramount in controlling this potential problem.

TABLE 97

WATER QUALITY CHARACTERISTICS
RUSSIAN RIVER HYDROGRAPHIC UNIT

Hydrographic subunit	Mineral classification	Range of dissolved mineral concentrations		
		Electrical conductivity (micromhos)	Hardness (ppm)	Boron (ppm)
SURFACE WATERS				
Forsythe Creek	Calcium-magnesium bicarbonate	178-185	73-78	0.20-0.30
Coyote Valley	Calcium-magnesium bicarbonate	134-285	60-133	0.07-0.37
Upper Russian River	Calcium-magnesium bicarbonate	81-699	36-140	0.00-13
Sulphur Creek	Magnesium-calcium bicarbonate	141-285	68-143	0.10-0.25
Middle Russian River	Calcium-magnesium bicarbonate	98-277	34-141	0.00-0.40
Dry Creek	Calcium-magnesium bicarbonate	133-286	57-112	0.10-1.7
Mark West	Calcium-magnesium bicarbonate	145-218	58-92	0.10-0.10
Santa Rosa	Sodium-calcium bicarbonate	203-928	65-212	0.00-0.89
Lower Russian River	Calcium-magnesium bicarbonate	118-253	51-112	0.00-0.40
Austin Creek	Magnesium bicarbonate	235	112	0.00

TABLE 97 (continued)

WATER QUALITY CHARACTERISTICS
RUSSIAN RIVER HYDROGRAPHIC UNIT

Hydrographic subunit	Mineral classification	Range of dissolved mineral concentrations		
		Electrical conductivity (micromhos)	Hardness (ppm)	Boron (ppm)
GROUND WATERS				
Forsythe Creek	Magnesium-sodium bicarbonate	205-1950	80-139	0.03-84
Coyote Valley	Magnesium bicarbonate	232-656	107-345	0.05-7.3
Upper Russian River	Magnesium-calcium bicarbonate	191-588	80-228	0.11-2.3
Middle Russian River	Magnesium-calcium bicarbonate	297-551	18-265	0.00-0.32
Dry Creek	Calcium-magnesium bicarbonate	199-364	59-178	0.02-0.67
Mark West	Sodium-magnesium bicarbonate	535-856	61-158	0.16-2.86
Santa Rosa	Magnesium-sodium bicarbonate	243-484	81-164	0.05-0.41
Laguna	Sodium bicarbonate	175-762	49-296	0.00-2.00
Lower Russian River	Sodium-calcium bicarbonate	155	42	0.01

CHAPTER III

WATER REQUIREMENTS

Historical and Present Development

North Coastal Hydrographic Area

First exploration of the coastal areas of California to the north of San Francisco Bay was credited to the Spanish adventurers of the sixteenth century.

Juan Cabrillo and Bartolome Ferrelo explored the north coast in the mid-sixteenth century, but failed to reach as far as the Humboldt region.

Sir Francis Drake's explorations under the English flag came shortly afterward, in 1579, but his explorations did not go north of Drake's Bay.

It was not until the eighteenth century that Trinidad Bay was discovered by Juan de la Bodega and Bruno de Beceta, who sailed into that harbor in 1775.

Discovery of Humboldt Bay was credited to Captain Johnathan Winship, in 1806.

Exploration in the interior of the area began only in the ninteenth century when Jedediah Smith crossed the Trinity River watershed while seeking a coastal route to Oregon. Trappers followed in his path, but no major settlements came until the discovery of gold in the Trinity River in 1848 by Major Pierson B. Reading.

Meanwhile, a Russian settlement began in 1811 at Fort Ross, but lasted only until 1841.

Russian, Spanish, and Mexican interest in the North Coastal area was slight, and development of the area was not given impetus until the United States took over Spanish claims in 1846.

Economy of the area is based largely on lumbering and the manufacturing of associated products, fishing, agriculture, mining, and recreation.

Trinity River Hydrographic Unit

The Trinity River Hydrographic Unit includes the entire watershed of the Trinity River and occupies 2,556 square miles of Trinity County and 413 square miles of Humboldt County.

Economic development of the area commenced after the discovery of gold in 1848, but after some six years of sporadic mining, most works were abandoned until the later advent of hydraulic mining under the impetus of demand for gold during the Civil War. Mining is now only a minor economic factor, with nonmetallic minerals contributing more than half of the value.

Towns sprang up to serve the needs of the early day miners, and Weaverville, established in 1850, became the main town. Other urban developments in this era were Lewiston, Willow Creek, and Hoopa.

Lumbering is the main industry of the watershed, which contains 1,112,000 acres of commercial timberland. The annual sustained yield of timber in the area is estimated by the U. S.

Forest Service as 410 million board feet. The principal types of trees are ponderosa pine, Douglas fir, and true firs. As of 1956, timber-associated industries produced more than $8 million worth of wood products annually.

Agriculture includes stock raising, dairying, and truck crops, and is not a major economic activity.

Recreation offers a large potential in the hydrographic unit, but limited access to the rugged terrain has restricted development. The Trinity River and several lakes lure the fisherman, while deer, bear, and quail abound for hunters.

Mad River-Redwood Creek Hydrographic Unit

Like the Trinity River Hydrographic Unit, the Mad-Redwood unit lies totally within Trinity and Humboldt Counties. It consists of 929 square miles of land area about 90 miles long, ranging in width from 5 to 20 miles.

Development of the unit stemmed from the developments associated with Eureka and Humboldt Bay, initially the only routes of access to the interior. Communities within the hydrographic unit are Blue Lake, McKinleyville, Crannell, and Trinidad.

It is to one of the early explorers of the region, Dr. Josiah Gregg, that the Mad River reputedly attributes its name. This legend is based on an account of an irrascible outburst by the intrepid explorer, who dashed into the frigid river waters in an effort to intercept members of his party whom he believed were abandoning him.

Forest products form the basic economic interest in the area. There is an estimated 20 billion board feet of standing timber, including redwood, Douglas fir, pine, and other conifers. Lumber manufacturing is estimated at a value of some $29 million annually.

Major agricultural products are dairy products, horticultural products, and livestock. Total farm products are valued at $2½ million annually.

Commercial fishing through the port city of Trinidad amounts to about 9 percent of the commercial fishing in Humboldt County.

There is some manganese ore mined commercially and nonmetallic mineral products are found along the lower reaches of the Mad River.

Recreational activity is presently confined largely to the state parks along the coast, but recreational development is expected to create added interest in the more rugged interior.

Eel River Hydrographic Unit

Five counties contribute in a greater or lesser degree to the geography of the Eel River Hydrographic Unit -- Trinity, Humboldt, Mendocino, Lake, and Glenn. The unit runs in a southwesterly direction from 10 miles north of Eureka near the mouth of the Mad River, to a point 10 miles northeast of Clear Lake. It is approximately 140 miles in length and has an average width of 32 miles.

In the mid-ninteenth century, fur traders were active in the area, followed by a period of commercial growth centering around supplying the mines and mining communities with a growing list of staples. Fisheries and flour mills were also reported, and as early as 1850 lumbering was getting established in the Humboldt Bay area.

At the present time the hydrographic unit has an estimated 1,525,000 acres of commercial timberland containing 38.2 billion board feet of timber. Within the decade, value of forest product output has stabilized at $150 million annually. The area also boasts the largest plywood production in California.

Recreational activity follows lumbering in value. The majestic redwood forests lure countless vacationers to the area, and the five redwood state parks reported nearly 2-1/2 million visitors in 1961. Steelhead and salmon fisheries, game hunting, and fishing are also important.

Agriculture is of more importance here than in neighboring units of the area, with some 72,000 acres of developed agricultural lands not including range land. Gross sale of farm products is estimated at $10 to $11 million annually. Dairy products plants and a wool textile mill add to this figure.

Commercial fishing, centering in the Eureka area, produces $1-3/4 million of catch each year, and fish processing plants also add to the economy.

There is some small scale mineral production, but it is not a major economic factor.

Mendocino Coast Hydrographic Unit

Mendocino Coast Hydrographic area lies along the western slope of the Coast Range and extends from Cape Vizcanio on the north to just south of Northwest Cape. It is 120 miles long and tapers north and south from the center of the unit which is about 25 miles wide. Its area is 1,359 square miles and includes parts of western Mendocino and northern Sonoma Counties.

First record of a white settlement in the unit was in 1811, when Ivan A. Kuskof established a settlement for the Russian-American Company as a base of supply for Alaska. He landed at Bodega Bay and developed a strip of land 18 miles to the north, later to be known as Fort Ross. The site was later abandoned because of poor crops and diminishing returns from otter hunting.

Starting with a development by Harry Meiggs, of San Francisco, lumbering grew in importance from the mid-ninteenth century. The lumbering industry still dominates the economy of the unit, with 29.3 billion board feet of timber stand reported in 1960.

Other economic bases include the processing of fish, dairy products, and other foods, and wine-making.

Agriculture is growing in importance, with principal products in terms of sales being beef cattle, apples, and sheep.

Sand, gravel, and stone have some minor importance, with these minerals being found principally along coastal streams.

Hunting and fishing attract sportsmen to the area, while unsurpassed scenery is a constant attraction for vacation seekers. Recreation is second only to lumbering and agriculture in importance to the unit's economy.

Russian River Hydrographic Unit

This unit, occupying 1,734 square miles, consists of parts of Mendocino, Sonoma, Lake, and Marin Counties.

The area was first explored by Juan Bodega, who claimed the land for Spain in 1775. An abortive effort to effect a landing by the English occurred in 1793, but the threat of Spanish guns discouraged the landing. In 1811 a Russian colonization effort centered north of Bodega Bay, but was abandoned in 1841. However, the Russian River won its name from this latter effort, having first been known as the Slavianka, meaning Russian, or Slav.

Development of the area started with the Americans taking over the Spanish claims in 1846. Trapping and hunting gave place to farming, and later lumber mill operations. The gold rush added to the area's population, although today mining is confined to non-metallic products along the Russian River.

Santa Rosa and Ukiah are the urban centers of the unit, with substantial retail, wholesale, and manufacturing enterprises.

In common with the other units of the North Coastal Hydrographic area, the Russian River Hydrographic Unit claims lumbering for its main industry. Agriculture and the processing of dairy, agricultural, and marine fishery products are also of importance.

Varied industries of the unit include mining of mercury, sand, and gravel; fabrication of specialized electrical machinery, boats, and furniture; and manufacture of clothing, leather products, and pipe.

Recreation is more varied than elsewhere in the North Coastal area. Summer resorts dot the lower Russian River, where the cool waters and tall redwoods attract countless summer visitors. There are adequate facilities for camping, hunting, and fishing. Mineral springs, the Luther Burbank Gardens, and an annual citrus fair are among special recreational attractions.

Future Water Requirements

Signs are plentiful that California's North Coast Hydrographic area is entering upon an era of economic growth and development. In addition, because of the rugged beauty of the region, it is likely that recreational attractions will share in the economy with presently developed agricultural and forestry operations as water development and improved access open the area to more and more visitors.

Although the total amount of water actually consumed by the recreation seeker is small, its consideration is important since it affects local demand in the timing of local water storage facilities development.

Timber processing will contribute increasingly to water demand in the future in view of anticipated growth of the pulp and paper mill industries. Expansion of these industries has already started and will account for a major portion of future municipal and industrial water requirements in such locations as the Humboldt Bay area.

Irrigated agricultural activity, not of major significance at the present time, except in limited areas, will increase in the future as new lands are brought under irrigation. The prospects for large increases within the study area are limited primarily by the relative lack of suitable land.

In the Trinity River Hydrographic Unit irrigable lands lie in a few relatively small valleys. In the Mad River-Redwood Creek Unit the irrigable potential is confined to the shelf of lands bordering the ocean. Agricultural lands in the Eel River Hydrographic Unit are largely confined to the dairy pasture lands of the Eel River floodplain and to Little Lake Valley and Round Valley in the interior.

The Mendocino Coast Hydrographic Unit has a substantial acreage of irrigable land; however, this land is widely scattered along the marine bench or along the narrow river canyons inland, except for land in Anderson Valley and the Point Arena area.

The area with the greatest potential for future irrigation development lies within the Russian River Hydrographic Unit, already a major fruit producing area. Here, irrigated agriculture is expected to play a prominent role in increasing the demand for water. Much of the presently dry farmed fruit acreage will be brought under irrigation by the year 2020 as a result of increasing economic demand.

Agricultural Water Requirements

Crop and marketing projections give every indication that California will continue to maintain its leadership in

Irrigation pump[cut off] Mad River Diver[cut off] 6N/1E-8L1

Sprinkler irrigation north of Arcata

agricultural production. From such projection studies, levels of future production and probable development of irrigated land may be estimated.

Although other areas of the State, notably the great Central Valley, will undoubtedly account for the greater share of this future development, the North Coastal area, too, will share in the increased production of agricultural products.

Cattle ranching and dairying will continue to be the principal agricultural activities in the areas north of the Russian River. The historical crop patterns of the Russian River drainage area will continue into the future, with anticipated greater use of irrigation on fruit and vineyard acreage. Substantial increases in culture of irrigated truck crops will result from demand stemming from the metropolitan complexes of the nearby San Francisco Bay area.

Land classification and use surveys conducted by the department and reported in the Bulletin No. 94 series provide a basis for locating areas where future irrigated agricultural development may occur, and indicate the present limited agricultural activity.

Studies based on these surveys indicate that the most likely future development of irrigation will occur on lands adjoining those presently under irrigation.

Historically, natural precipitation in many areas has been sufficient for acceptable production levels, and consequently much of the crop land has not been irrigated. Even when irrigation has been utilized, as in the Lower Eel River floodplains, the rate of application has been small in comparison to areas such as the Central Valley. Pressure of increased competition and growing demand may in the future require irrigation of previously dry farmed lands, and may place under full irrigation lands that have previously been receiving less than the optimum supply of water.

The amount of water per acre needed annually for irrigation of a specific crop was determined through examination of irrigation water district records, information developed from earlier reports, and from consideration of the opinions of local agricultural experts. These amounts of water were then applied to the projected crop acreages to arrive at total farm irrigation water requirements.

Table 98 shows present and estimated future crop acreages within the study area and the total amount of available land that meets minimum requirements for irrigated agricultural development.

The table also shows the irrigation requirement of anticipated crops, the expected encroachment on irrigable land by expanding urban development, and the remaining amounts of irrigable land that are available for either urban or agricultural development by the year 2020.

The projections of irrigated crop acreage shown in this bulletin are those which have been estimated to occur under the presumption of water being made available at a price commensurate with the ability of irrigated agriculture to pay for irrigation supplies.

TABLE 98

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	2020 Remaining undeveloped net irrigable lands (acres)
								TRINITY RIVER HYDROGRAPHIC UNIT								
A	Trinity Reservoir	Trinity	459,800	458,810	990	310	680	Alfalfa	-	-	50	170	70	200		
								Pasture	-	-	330	1,220	430	1,590		
	Total		459,800	458,810	990	310	680				380	1,390	500	1,790	-	180
B	Weaver Creek	Trinity	31,800	31,240	560	160	400	Pasture	30	110	190	700	250	930		
	Total		31,800	31,240	560	160	400		30	110	190	700	250	930	50	100
C	Middle Trinity	Trinity	157,000	155,350	1,650	310	1,340	Alfalfa	130	430	140	460	170	560		
								Orchard	-	-	50	110	70	150		
								Pasture	390	1,440	590	2,180	750	2,780		
	Total		157,000	155,350	1,650	310	1,340		520	1,870	780	2,750	990	3,490	-	350
D	Relena	Trinity	176,900	176,780	120	40	80	Alfalfa	20	70	-	-	-	-		
								Orchard	10	20	-	-	-	-		
								Pasture	10	40	30	110	30	110		
	Total		176,900	176,780	120	40	80		40	130	30	110	30	110	50	-
E	New River	Trinity	150,300	149,960	340	80	260	Alfalfa	30	100	40	130	50	170		
								Orchard	30	70	20	40	40	90		
								Pasture	30	110	80	300	110	410		
	Total		150,300	149,960	340	80	260		90	280	140	470	200	670	-	60
F	Burnt Ranch	Trinity	134,600	133,520	1,080	220	860	Alfalfa	10	30	50	170	130	430		
								Orchard	10	20	20	40	40	90		
								Pasture	130	480	340	1,260	420	1,550		
								Truck	-	-	10	20	20	40		
	Total		134,600	133,520	1,080	220	860		150	530	420	1,490	610	2,110	60	190
G	Hayfork Valley	Trinity	172,200	163,890	8,310	1,520	6,790	Alfalfa	120	400	350	1,160	400	1,320		
								Orchard	-	-	140	310	210	460		
								Pasture	920	3,400	3,220	11,910	4,150	15,360		
								Truck	-	-	70	140	90	180		
	Total		172,200	163,890	8,310	1,520	6,790		1,040	3,800	3,780	13,520	4,850	17,320	-	1,940
H	Hayfork Creek	Trinity	70,300	69,540	760	130	630	Alfalfa	30	100	70	230	80	260		
								Pasture	80	300	300	1,110	390	1,440		
	Total		70,300	69,540	760	130	630		110	400	370	1,340	470	1,700	-	160

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES
AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	2020 Remaining undeveloped net irrigable lands (acres)
	TRINITY RIVER HYDROGRAPHIC UNIT (Continued)															
J	Upper South Fork	Trinity	219,500	218,890	610	160	450	Alfalfa	10	30	30	100	40	130		
								Pasture	10	40	230	850	160	590		
	Total		219,500	218,890	610	160	450		20	70	260	950	200	720	170	80
K	Hyampom	Trinity	24,000	23,100	900	170	730	Alfalfa	70	230	100	330	-	-		
								Pasture	110	410	330	1,220	30	110		
								Subtotal	180	640	430	1,550	30	110	700	-
		Humboldt	3,900	3,900	-	-			-	-	-	-	-	-	-	-
	Total		27,900	27,000	900	170	730		180	640	430	1,550	30	110	700	-
L	Lower South Fork	Trinity	37,600	37,190	410	70	340	Alfalfa	10	30	30	100	40	130		
								Pasture	50	190	160	590	210	780		
								Subtotal	60	220	190	690	250	910	-	90
		Rumboldt	68,800	68,630	170	50	120	Alfalfa	-	-	20	70	30	100		
								Pasture	10	40	50	190	60	230		
								Subtotal	10	40	70	260	90	330	-	30
	Total		106,400	105,820	580	120	460		70	260	260	950	340	1,240	-	120
M	Willow Creek	Rumboldt	38,900	37,610	1,290	170	1,120	Alfalfa	40	130	70	230	80	260		
								Orchard	20	40	50	110	70	150		
								Pasture	30	110	490	1,810	630	2,330		
								Truck	20	40	30	60	40	80		
								Subtotal	110	320	640	2,210	820	2,820	-	300
		Trinity	1,800	1,780	20	20			-	-	-	-	-	-	-	-
	Total		40,700	39,390	1,310	190	1,120		110	320	640	2,210	820	2,820	-	300
N	Hoopa	Humboldt	152,800	150,390	2,410	400	2,010	Alfalfa	40	130	200	660	250	830		
								Orchard	-	-	20	40	40	90		
								Pasture	140	520	900	3,330	1,160	4,290		
								Truck	10	20	40	80	50	100		
	Total		152,800	150,390	2,410	400	2,010		190	670	1,160	4,110	1,500	5,310	-	510
HYDROGRAPHIC UNIT TOTALS			1,900,200	1,880,580	19,620	3,810	15,810		2,550	9,080	8,840	31,540	10,790	38,320	1,030	3,990

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	2020 Remaining undeveloped net irrigable lands (acres)
	MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT															
A	Ruth	Trinity	91,350	90,630	720	130	590	Pasture	20	40	60	130	150	330		
	Total		91,350	90,630	720	130	590		20	40	60	130	150	330	100	340
B	Butler Valley	Humboldt	150,040	148,950	1,090	220	870	Pasture	110	240	360	790	600	1,320		
								Deciduous	10	20	-	-	-	-		
								Subtotal	120	260	360	790	600	1,320	100	170
		Trinity	9,990	9,960	30	10	20		-	-	-	-	-	-	-	20
	Total		160,030	158,910	1,120	230	890		120	260	360	790	600	1,320	100	190
C	North Fork	Humboldt	29,930	29,620	310	80	230	Pasture	-	-	30	50	30	50		
	Total		29,930	29,620	310	80	230		-	-	30	50	30	50	170	30
D	Blue Lake	Humboldt	41,910	26,810	15,100	2,260	12,840	Pasture	2,100	3,580	6,500	11,100	4,600	7,820		
								Truck	200	400	600	960	900	1,440		
								Field	20	20	400	400	300	300		
	Total		41,910	26,810	15,100	2,260	12,840		2,320	4,000	7,500	13,830	5,800	9,560	5,500	1,540
E	Snow Camp	Humboldt	43,290	43,120	170	20	150	Paature	-	-	40	80	100	200		
	Total		43,290	43,120	170	20	150		-	-	40	80	100	200	-	50
F	Beaver	Humboldt	68,370	68,080	290	70	220	Pasture	40	80	55	110	70	140		
	Total		68,370	68,080	290	70	220		40	80	55	110	70	140	100	50
G	Orick	Humboldt	76,250	74,780	1,470	180	1,290	Pasture	330	560	800	1,360	600	1,020		
								Truck	-	-	200	320	200	320		
	Total		76,250	74,780	1,470	180	1,290		330	560	1,000	1,680	800	1,340	400	90
H	Big Lagoon	Humboldt	54,020	50,680	3,340	560	2,780	Pasture	110	190	650	1,100	1,150	1,960		
								Truck	-	-	100	160	250	400		
	Total		54,020	50,680	3,340	560	2,780		110	190	750	1,260	1,400	2,360	1,000	380
J	Little River	Humboldt	29,260	27,810	1,450	220	1,230	Deciduous	230	300	400	520	300	390		
								Truck	40	90	150	240	100	160		
	Total		29,260	27,810	1,450	220	1,230		270	390	550	760	400	550	700	130

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES
AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	2020 Remaining undeveloped net irrigable lands (acres)
								MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT (Continued)								
HYDROGRAPHIC UNIT TOTALS			594,410	570,440	23,970	3,750	20,220		3,210	5,520	10,345	18,690	9,350	15,850	8,070	2,800
								EEL RIVER HYDROGRAPHIC UNIT								
A	Lake Pillsbury	Glenn	13,950	13,950	-	-	-	-	-	-	-	-	-	-		
		Lake	188,090	186,330	1,760	350	1,410	Pasture	10	30	120	360	230	690	-	1,180
		Mendocino	20,190	19,690	500	120	380	Pasture	-	-	40	120	80	240	-	300
	Total		222,230	219,970	2,260	470	1,790		10	30	160	480	310	930	-	1,480
B	Outlet Creek	Mendocino	104,290	88,510	15,780	2,470	13,310	Grain	-	-	100	40	300	120		
								Pasture	300	750	2,200	5,500	4,000	10,000		
								Alfalfa	-	-	300	690	800	1,840		
								Field	-	-	800	1,200	1,900	2,850		
	Total		104,290	88,510	15,780	2,470	13,310		300	750	3,400	7,430	7,000	14,810	2,200	4,110
C	Willis Ridge	Mendocino	127,050	123,400	3,650	790	2,860	Pasture	130	350	480	1,300	900	2,430	-	1,960
		Lake	210	210	-	-	-	-	-	-	-	-	-	-	-	-
	Total		127,260	123,610	3,650	790	2,860		130	350	480	1,300	900	2,430	-	1,960
D	Round Valley	Mendocino	82,590	64,860	17,730	2,170	15,560	Grain	-	-	200	100	600	300		
								Pasture	560	1,680	2,400	7,200	4,500	13,500		
								Alfalfa	-	-	700	1,960	2,500	7,700		
								Field	-	-	1,000	1,800	3,400	6,120		
								Orchard	30	60	500	1,000	1,000	2,000		
	Total		82,590	64,860	17,730	2,170	15,560		590	1,740	4,800	12,060	12,000	29,620	1,000	2,560
E	Wilderness	Mendocino	55,640	55,610	30	10	20	-	-	-	-	-	-	-	-	20
		Trinity	75,800	75,800	-	-	-	-	-	-	-	-	-	-	-	-
	Total		131,440	131,410	30	10	20		-	-	-	-	-	-	-	20
F	Black Butte	Glenn	39,600	39,550	50	10	40	Pasture	-	-	10	20	40	80	-	-
		Lake	2,160	2,160	-	-	-	-	-	-	-	-	-	-	-	-
		Mendocino	62,100	61,980	120	40	80	-	-	-	-	-	-	-	-	80
	Total		103,860	103,690	170	50	120	-	-	-	10	20	40	80	-	80

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	2020 Remaining undeveloped net irrigable lands (acres)
								EEL RIVER HYDROGRAPHIC UNIT (Continued)								
G	Etsel	Lake	220	220	-	-	-	-	-	-	-	-	-	-	-	-
		Mendocino	163,920	160,620	3,300	730	2,570	Pasture	-	-	390	1,050	900	2,430	-	1,670
	Total		164,140	160,840	3,300	730	2,570		-	-	390	1,050	900	2,430	-	1,670
H	North Fork	Mendocino	57,190	56,300	890	200	690	Pasture	10	30	60	150	100	250	-	590
		Trinity	124,160	122,370	1,790	340	1,450	Pasture	30	80	110	280	200	500	-	1,250
	Total		181,350	178,670	2,680	540	2,140		40	110	170	430	300	750	-	1,840
J	Bell Springs	Humboldt	42,170	41,970	200	30	170	Pasture	-	-	30	80	70	180	-	100
		Mendocino	117,590	116,960	630	160	470	Pasture	-	-	40	100	70	180	-	400
		Trinity	54,520	54,120	400	90	310	Pasture	60	150	90	230	120	300	-	190
	Total		214,280	213,050	1,230	280	950		60	150	160	410	260	660	-	690
K	Sequoia	Humboldt	95,350	94,160	1,190	200	990	Pasture	140	350	310	780	490	1,230	-	500
		Trinity	24,400	24,150	250	60	190	Pasture	40	100	60	150	70	180	-	120
	Total		119,750	118,310	1,440	260	1,180		180	450	370	930	560	1,410	-	620
L	Yeager Creek	Humboldt	84,640	84,340	300	60	240	Pasture	-	-	60	150	140	350	-	100
	Total		84,640	84,340	300	60	240		-	-	60	150	140	350	-	100
M	Van Duzen River	Humboldt	149,720	142,690	7,030	1,160	5,870	Grain	-	-	-	-	100	30		
								Pasture	1,050	2,310	2,600	5,720	3,000	6,600		
								Alfalfa	20	40	200	400	300	600		
								Field	-	-	100	130	300	390		
								Truck	-	-	100	130	300	390		
								Subtotal	1,070	2,350	3,000	6,380	4,000	8,010	800	1,070
		Trinity	40,080	38,360	1,720	290	1,430	Pasture	-	-	50	110	150	330	-	1,280
	Total		189,800	181,050	8,750	1,450	7,300		1,070	2,350	3,050	6,490	4,150	8,340	800	2,350
N	Larabee Creek	Humboldt	53,880	53,310	570	110	460	Pasture	50	130	80	200	100	250	-	360
	Total		53,880	53,310	570	110	460		50	130	80	200	100	250	-	360

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES
AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	2020 Remaining undeveloped net irrigable lands (acres)
								EEL RIVER HYDROGRAPHIC UNIT (Continued)								
P	Laytonville	Mendocino	80,090	69,520	10,570	1,850	8,720	Grain	-	-	100	40	100	40		
								Pasture	170	430	1,000	2,500	2,000	5,000		
								Alfalfa	-	-	200	460	500	1,150		
								Field	-	-	300	450	900	1,350		
	Total		80,090	69,520	10,570	1,850	8,720		170	430	1,600	3,450	3,500	7,540	-	5,220
Q	Lake Benbow	Humboldt	102,880	101,320	1,560	300	1,260	Pasture	160	350	600	1,320	-	-	1,260	-
		Mendocino	161,050	159,130	1,920	430	1,490	Pasture	20	40	300	660	-	-	1,490	-
	Total		263,930	260,450	3,480	730	2,750		180	390	900	1,980	-	-	2,750	-
R	Humboldt Redwoods	Humboldt	97,430	96,560	870	150	720	Pasture	60	130	300	660	-	-		
								Field	10	10	-	-	-	-		
								Truck	10	10	-	-	-	-		
								Orchard	10	20	-	-	-	-		
	Total		97,430	96,560	870	150	720		90	170	300	660	-	-	720	-
S	Lower Eel	Humboldt	137,080	98,870	38,210	4,840	33,370	Grain	40	10	200	40	300	60		
								Pasture	10,860	18,460	20,500	34,850	19,000	32,300		
								Alfalfa	310	470	800	1,200	1,000	1,500		
								Field	50	50	700	700	1,000	1,000		
								Truck	30	30	300	300	1,000	1,000		
	Total		137,080	98,870	38,210	4,840	33,370		11,290	19,020	22,500	37,090	22,300	35,860	5,300	5,770
T	Eureka Plain	Humboldt	141,250	115,680	25,570	3,600	21,970	Grain	20	-	100	20	100	20		
								Pasture	2,430	4,130	4,200	7,140	2,700	4,590		
								Alfalfa	-	-	300	450	200	300		
								Field	30	30	300	300	200	200		
								Truck	50	50	100	100	200	200		
	Total		141,250	115,680	25,570	3,600	21,970		2,530	4,210	5,000	8,010	3,400	5,310	17,800	770
U	Cape Mendocino	Humboldt	311,320	304,550	6,770	1,210	5,560	Grain	10	-	100	40	200	80		
								Pasture	430	1,080	1,000	2,500	1,200	3,000		
								Alfalfa	40	90	400	920	700	1,610		
								Field	-	-	300	450	700	1,050		
								Truck	-	-	-	-	300	450		
								Orchard	30	50	200	320	400	640		
								Subtotal	510	1,220	2,000	4,230	3,500	6,830	-	2,060
		Mendocino	8,030	7,990	40	10	30	Pasture	10	30	10	30	10	30	-	20
	Total		319,350	312,540	6,810	1,220	5,590		520	1,250	2,010	4,260	3,510	6,860	-	2,080
HYDROGRAPHIC UNIT TOTAL			2,818,640	2,675,240	143,400	21,780	121,620		17,210	31,530	45,440	86,400	59,370	117,630	30,570	31,680

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES
AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	Remaining undeveloped net irrigable lands (acres)
								MENDOCINO COAST HYDROGRAPHIC UNIT								
A	Rock Port	Mendocino	146,674	142,967	3,707	557	3,150	Pasture	90	150	800	1,360	1,000	1,700		
								Grain	80	20	200	40	200	40		
								Truck	10	10	100	70	100	70		
	Total		146,674	142,967	3,707	557	3,150		180	180	1,100	1,470	1,300	1,810	500	1,350
B	Fort Bragg	Mendocino	279,506	240,596	38,910	6,310	32,600	Pasture	40	70	580	970	2,300	3,910		
								Truck	20	10	300	210	600	420		
								Grain	10	-	100	20	400	80		
								Orchard	-	-	20	10	100	40		
	Total		279,506	240,596	38,910	6,310	32,600		70	80	1,000	1,210	3,400	4,450	8,000	21,200
C	Navarro River	Mendocino	201,900	189,582	12,318	1,668	10,650	Pasture	300	750	700	1,750	2,500	6,250		
								Grain	130	50	100	40	100	40		
								Orchard	280	420	400	490	800	1,010		
								Field	-	-	100	120	600	720		
								Alfalfa	20	40	100	200	300	600		
								Truck	20	20	-	-	-	-		
	Total		201,900	189,582	12,318	1,668	10,650		750	1,280	1,400	2,600	4,300	8,620	870	5,480
D	Point Arena	Mendocino	173,434	155,439	17,995	3,195	14,800	Pasture	890	1,520	1,500	2,550	3,800	6,470		
								Truck	60	40	200	140	800	560		
								Grain	90	20	300	60	1,400	280		
								Field	20	10	-	-	-	-		
	Total		173,434	155,439	17,995	3,195	14,800		1,060	1,590	2,000	2,750	6,000	7,310	2,700	6,100
E	Gualala River	Mendocino	68,592	61,842	6,750	1,600	5,150	Pasture	10	20	70	120	150	260	1,000	
		Sonoma	153,611	146,194	7,417	1,417	6,000	Pasture	20	30	200	340	400	680	-	
	Total		222,203	208,036	14,167	3,017	11,150		30	50	270	460	550	940	1,000	9,600
HYDROGRAPHIC UNIT TOTAL			1,023,717	936,620	87,097	14,747	72,350		2,090	3,180	5,770	8,490	15,550	23,130	13,070	43,730
								RUSSIAN RIVER HYDROGRAPHIC UNIT								
A	Coyote Valley	Lake	753	722	31	11	20		-	-	-	-	-	-		
		Mendocino	66,466	56,180	10,286	1,346	8,940	Orchard	580	990	2,500	4,250	3,500	5,950		
								Vinyard	-	-	1,000	920	2,000	1,880		
								Pasture	3,880	13,580	3,100	10,850	1,500	5,250		
								Field	280	500	500	900	300	540		
								Alfalfa	150	450	500	1,500	300	900		
								Subtotal	4,890	15,520	7,600	18,420	7,600	14,520	100	
	Total		67,219	56,902	10,317	1,357	8,960		4,890	15,520	7,600	18,420	7,600	14,520	100	1,260

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES
AND IRRIGATIONAL WATER REQUIREMENT

Subunit		County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960		1990		2020			
Code	Name								Net irrigated (acres)	Farm irrigation requirement (acre-feet)	Net irrigated (acres)	Farm irrigation requirement (acre-feet)	Net irrigated (acres)	Farm irrigation requirement (acre-feet)	Net irrigable lands encroached upon by urban 3/ (acres)	Remaining undeveloped net irrigable lands (acres)
								RUSSIAN RIVER HYDROGRAPHIC UNIT (Continued)								
B	Forsythe Creek	Mendocino	53,538	45,646	7,892	1,182	6,710	Orchard	70	120	1,000	1,700	1,300	2,210		
								Vinyard	-	-	1,000	1,000	2,000	2,040		
								Pasture	40	140	700	2,450	500	1,750		
								Truck	40	70	100	180	300	540		
	Total		53,538	45,646	7,892	1,182	6,710		150	330	2,800	5,330	4,100	6,540	1,300	1,310
C	Upper Russian	Lake	1,954	1,954	-	-	-	-	-	-	-	-	-	-		
		Mendocino	198,794	174,086	24,708	3,228	21,480	Orchard	3,810	6,480	7,000	11,900	6,500	11,210		
								Vinyard	240	190	3,700	3,640	3,000	2,840		
								Pasture	1,070	3,750	2,000	7,000	2,000	7,000		
								Field	270	490	500	900	700	1,260		
								Truck	50	90	500	900	500	900		
								Grain	20	10	300	150	200	100		
								Alfalfa	470	1,410	500	1,500	800	2,400		
	Total		200,748	176,040	24,708	3,228	21,480		5,930	12,420	14,500	25,990	13,700	25,710	5,400	2,380
D	Sulphur Creek	Lake	173	173	-	-	-	-	-	-	-	-	-	-	-	
		Mendocino	3,070	3,051	19	19	-	-	-	-	-	-	-	-	-	
		Sonoma	48,936	47,947	989	309	680	Pasture	20	70	40	140	100	350	-	
	Total		52,179	51,171	1,008	328	680		20	70	40	140	100	350	-	580
E	Middle Russian	Mendocino	9,352	8,790	562	122	440	Orchard	-	-	-	-	100	160		
								Pasture	30	100	100	330	100	330		
								Subtotal	30	100	100	330	200	490		
		Sonoma	124,032	93,117	30,915	5,505	25,410	Orchard	4,390	7,020	8,000	12,960	9,400	15,540		
								Vinyard	1,080	760	3,000	2,980	4,500	4,430		
								Pasture	1,690	5,580	3,000	9,900	2,500	8,250		
								Truck	70	110	500	800	700	1,120		
								Field	100	160	1,000	1,600	500	800		
								Alfalfa	310	870	1,000	2,800	500	1,400		
								Grain	20	10	400	200	300	150		
								Subtotal	7,660	14,510	16,900	31,240	18,400	31,690	1,200	
	Total		133,384	101,907	31,477	5,627	25,850		7,690	14,610	17,000	31,570	18,600	32,180	1,200	6,050
F	Santa Rosa	Sonoma	50,065	30,785	19,280	3,860	15,420	Orchard	140	240	200	340	200	340		
								Vinyard	-	-	200	180	200	180		
								Pasture	1,950	5,460	1,500	4,200	100	280		
								Truck	150	210	300	420	-	-		
								Field	280	390	200	280	-	-		
								Grain	90	40	100	40	-	-		
	Total		50,065	30,785	19,280	3,860	15,420		2,610	6,340	2,500	5,460	500	800	12,800	2,120

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES
AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	2020 Remaining undeveloped net irrigable lands (acres)
								RUSSIAN RIVER HYDROGRAPHIC UNIT (Continued)								
G	Laguna	Sonoma	56,653	19,179	37,474	5,894	31,580	Orchard	170	150	3,000	2,620	4,000	3,520		
								Vinyard	-	-	500	450	500	450		
								Pasture	2,300	6,440	4,000	11,200	2,500	7,000		
								Truck	100	140	2,000	2,800	3,000	4,200		
								Field	140	200	3,500	4,900	2,000	2,800		
								Alfalfa	170	390	1,500	3,700	1,000	2,550		
								Grain	60	20	1,500	600	500	200		
	Total		56,653	19,179	37,474	5,894	31,580		2,940	7,340	16,000	26,270	13,500	20,720	15,400	2,680
H	Mark West	Sonoma	55,676	28,326	27,350	5,130	22,220	Orchard	990	1,680	3,000	4,900	3,500	5,670		
								Vinyard	30	20	1,000	700	1,500	1,030		
								Pasture	1,970	5,520	3,000	8,400	1,500	4,200		
								Truck	130	180	500	700	1,500	2,100		
								Field	320	450	1,000	1,400	500	700		
								Alfalfa	140	320	1,000	2,400	500	1,150		
								Grain	70	30	500	200	300	120		
	Total		55,676	28,326	27,350	5,130	22,220		3,650	8,200	10,000	18,700	9,300	14,970	8,700	4,220
J	Dry Creek	Mendocino	26,118	24,899	1,219	279	940	Pasture	10	30	100	300	200	600	-	
		Sonoma	112,898	99,806	13,092	2,422	10,670	Orchard	1,720	2,410	4,000	5,720	4,000	5,720		
								Vinyard	170	100	1,500	1,220	1,500	1,220		
								Pasture	550	1,650	800	2,400	300	900		
								Truck	70	110	100	150	200	300		
								Subtotal	2,510	4,270	6,400	9,490	6,000	8,140	1,300	
	Total		139,016	124,705	14,311	2,701	11,610		2,520	4,300	6,500	9,790	6,200	8,740	1,300	4,110
K	Austin Creek	Sonoma	44,676	44,257	419	109	310	-	-	-	-	-	-	-		
	Total		44,676	44,257	419	109	310		-	-	-	-	-	-	-	310
L	Lower Russian	Sonoma	97,356	68,413	28,943	5,643	23,300	Orchard	1,790	2,330	6,000	9,400	10,500	16,390		
								Vinyard	130	70	1,000	500	2,000	1,200		
								Pasture	1,340	3,750	2,500	7,000	2,000	5,600		
								Truck	230	320	500	700	1,000	1,400		
								Field	280	390	400	560	500	700		
								Alfalfa	230	530	500	1,150	500	1,150		
								Grain	40	20	100	40	200	80		
	Total		97,356	68,413	28,943	5,643	23,300		4,040	7,410	11,000	19,350	16,700	26,520	1,400	5,200

TABLE 98 (Continued)

PRESENT AND ESTIMATED FUTURE AGRICULTURAL ACREAGES
AND IRRIGATIONAL WATER REQUIREMENT

Subunit Code	Subunit Name	County	Total area (acres)	Non-irrigable lands 1/ (acres)	Gross irrigable lands (acres)	Reduction from gross to net 2/ (acres)	Net irrigable lands (acres)	Crops	1960 Net irrigated (acres)	1960 Farm irrigation requirement (acre-feet)	1990 Net irrigated (acres)	1990 Farm irrigation requirement (acre-feet)	2020 Net irrigated (acres)	2020 Farm irrigation requirement (acre-feet)	2020 Net irrigable lands encroached upon by urban 3/ (acres)	2020 Remaining undeveloped net irrigable lands (acres)
								RUSSIAN RIVER HYDROGRAPHIC UNIT (Continued)								
M	Bodega	Marin	23,893	11,340	12,553	3,983	8,570	Orchard	-	-	-	-	200	200		
								Truck	-	-	-	-	500	500		
								Pasture	20	40	200	400	700	1,400		
								Field	-	-	-	-	400	400		
								Alfalfa	-	-	100	150	200	350		
								Subtotal	20	40	300	550	2,000	2,850		
		Sonoma	72,437	40,342	32,095	9,355	22,740	Orchard	-	-	-	-	1,500	1,680		
								Truck	20	20	50	50	2,000	2,000		
								Pasture	380	760	550	1,100	1,500	3,000		
								Field	-	-	50	50	1,000	1,000		
								Alfalfa	-	-	50	70	600	1,050		
								Subtotal	400	780	700	1,270	6,600	8,730	900	
	Total		96,330	51,682	44,648	13,338	31,310		420	820	1,000	1,820	8,600	11,580	900	21,810
N	Walker Creek	Marin	60,623	45,801	14,822	3,722	11,100	Truck	-	-	-	-	700	700		
								Pasture	30	60	300	600	600	1,200		
								Field	-	-	50	50	600	600		
								Alfalfa	-	-	50	80	100	150		
								Subtotal	30	60	400	730	2,000	2,650	1,500	
		Sonoma	2,590	644	1,946	546	1,400	Truck	-	-	-	-	200	200		
								Pasture	-	-	100	200	200	400		
								Field	-	-	-	-	100	100		
								Subtotal	-	-	100	200	500	700	-	
	Total		63,213	46,445	16,768	4,268	12,500		30	60	500	930	2,500	3,350	1,500	8,500
HYDROGRAPHIC UNIT TOTALS			1,110,053	845,458	264,595	52,665	211,930		34,890	77,420	89,440	163,770	101,400	165,980	50,000	60,530

1/ Includes urban, lands deemed best suited to remain in forest or range management, recreational, and all other non-irrigable lands.
2/ This reduction necessary to account for such non-water service areas as roads and rights-of-way; small, irregularly shaped bodies of land; fallow landa; etc.
3/ For the Trinity River Hydrographic Unit, the acreages shown in this column also include net irrigable acres of land inundated by possible reservoirs.

While these projections were not made for a variety, or complete cost of water spectrum, payment ability of irrigated agriculture to support the quantities of water needed for these crop patterns has been tested against the developmental costs of several alternative sources of irrigation supply.

In all instances the weighted average payment capacity of land and water exceeded the estimated developmental cost of applied water. These costs have been variously estimated by the State Department of Water Resources, and the U. S. Bureau of Reclamation and the U. S. Corps of Engineers as being about $10 to $12 per acre-foot.

Under these circumstances it was considered unnecessary to design alternative crop patterns for the complete spectrum of water costs.

Municipal and Industrial Water Requirements

It is predicted that the population of the North Coastal Hydrographic area will quadruple by the year 2020.

The majority of people will be living in urban areas, with most of the remainder classified as "rural nonfarm," that is, people living outside the major urban complexes, but deriving their income from other than farm enterprises. Table 99 presents present population (1960) and estimates of future population for each hydrographic unit in the study area. Table 100 presents similar population data for counties and portions of counties in the study area.

Logging on the Trinity River

Pacific Lumber Company at Scotia

Lumbering and its associated industries and recreation will outstrip agriculture in contributing to the anticipated population increase. Vertical economic integration within the forest products industry, through further development of pulp, plywood, veneer, and particle board manufacturing, will make a major contribution in this respect. It is not unduly optimistic to expect that the forest product industry, through this integration, when coupled with improved forest management, can multiply several times over its present gross product value.

Full development of the lumbering resources by the year 2020 most likely will result from the future demand for wood products and the anticipated demand for pulp and paper products.

Also affecting population trends for the future will be the tremendous increase in demand for recreational facilities and recreation areas. The wonderland of natural beauty and scenic attractions that is the North Coastal area must inevitably provide services to an ever-increasing number of recreation seekers by the year 2020.

The estimate of a quadrupled population by that year is based upon employment opportunities and the relation of employment to total area population.

Eighty-five percent of the population of the study area is currently located in the Eel and Russian River Hydrographic Units, particularly in the Humboldt Bay area and in and near Ukiah and Santa Rosa. This percentage is expected to remain approximately the same.

TABLE 99

ESTIMATED PRESENT AND FUTURE POPULATION[1]
BY HYDROGRAPHIC UNITS (1960-2020)

Hydrographic unit Residence by area classification	1960	1990	2020
Trinity River			
Urban	6,300	12,150	18,950
Rural nonfarm	5,650	8,250	11,250
Rural farm	250	300	400
Total	12,200	20,700	30,600
Mad River-Redwood Creek			
Urban	10,700	40,000	82,000
Rural nonfarm	4,150	10,200	7,650
Rural farm	200	300	450
Total	15,050	50,500	90,100
Eel River			
Urban	57,450	140,100	303,200
Rural nonfarm	36,350	57,950	75,500
Rural farm	4,400	5,200	5,400
Total	98,200	203,250	384,100
Mendocino Coast			
Urban	14,900	33,000	65,000
Rural nonfarm	2,250	6,950	8,800
Rural farm	900	1,050	1,200
Total	18,050	41,000	75,000
Russian River			
Urban	91,100	269,300	486,000
Rural nonfarm	26,150	59,100	73,300
Rural farm	13,350	15,800	16,100
Total	130,600	344,200	575,400
Five Hydrographic Units			
Total urban	180,450	494,550	955,150
Total rural nonfarm	74,550	142,450	176,500
Total rural farm	19,100	22,650	23,550
GRAND TOTAL[2]	274,100	659,650	1,155,200

1/ Population for 1960 based on U.S. Census. Figures for 1990 and 2020 are based on regional projections appearing in Bulletin No. 78, DWR publication, with adjustments for more detailed projections of economic development in individual counties and hydrographic units.

2/ Includes population in all of the land area of Trinity and Mendocino Counties; 86% of Humboldt; 84% of Sonoma; 31% of Marin and 24% of Lake.

TABLE 100

ESTIMATED PRESENT AND FUTURE POPULATIONS
NORTH COASTAL AREA COUNTIES*
1960-2020

County	1960		1990		2020	
	Total population	Population within study area	Total population	Population Within study area	Total population	Population within study area
Trinity	9,700	9,700	17,850	17,850	26,600	26,600
Humboldt	104,900	103,950	234,650	233,050	438,100	435,600
Mendocino	51,050	51,050	125,000	125,000	225,000	225,000
Glenn	17,250	0	42,800	0	104,000	0
Lake	13,800	50	33,000	450	101,000	1,000
Sonoma	147,400	106,300	400,000	277,300	700,000	457,000
Marin	146,800	3,050	440,000	6,000	680,000	10,000
TOTAL	490,900	274,100	1,293,300	659,650	2,274,700	1,155,200

* California counties, all or part of which are drained by streams within the study area.

Examination of records of water service agencies yielded daily per capita water requirements for these areas. The resultant values, increased slightly to reflect possible changes in modes of living and make-up of the industrial community, were applied to population estimates to determine future water requirements for all municipal and industrial development except pulp and paper mills.

Water requirements for pulp and paper mills were estimated on a basis of the following assumptions: that basic resources employed would reach optimum use by the year 2020; that mill effluent would be discharged directly into the ocean to preclude pollution of local streams by these waste discharges; and that practically all of the paper produced would be bleached. These water requirements are presented in Table 101.

TABLE 101

ESTIMATED FUTURE WATER REQUIREMENTS OF THE PROJECTED PULP AND PAPER INDUSTRIES
(In Acre-Feet)

Hydrographic unit and subunit	1960	1990	2020
Mad River-Redwood Creek			
F-5-D Blue Lake	--	19,600	38,600
Eel River			
F-6-T Eureka Plain	--	54,600	77,200
F-6-S Lower Eel	--	19,600	38,600
Mendocino Coast			
F-8-B Fort Bragg	--	20,400	28,000

Table 102 presents the total of all municipal and industrial water requirements including those for pulp and paper mills.

Fishing on the Trinity River

Avenue of the Giants

TABLE 102

MUNICIPAL AND INDUSTRIAL WATER REQUIREMENTS
(In Acre-feet)

Hydrographic unit/subunit	County	1960	1990	2020
Trinity River H.U.				
A Trinity Reservoir	Trinity	100	400	700
B Weaver Creek	Trinity	500	1,000	1,500
C Middle Trinity	Trinity	400	200	400
D Helena	Trinity	--	100	200
E New River	Trinity	--	--	100
F Burnt Ranch	Trinity	200	300	600
G Hayfork Valley	Trinity	500	900	1,400
H Hayfork Creek	Trinity	--	--	100
J Upper South Fork	Trinity	--	--	100
K Hyampom	Trinity	100	100	--
L Lower South Fork	Trinity	--	--	100
	Humboldt	--	--	--
M Willow Creek	Humboldt	100	200	400
N Hoopa	Humboldt	500	600	700
Hydrographic Unit Total		2,400	3,800	6,300
Mad River-Redwood Creek H.U.				
A Ruth	Trinity	--	--	100
B Butler Valley	Humboldt	--	100	200
C North Fork	Humboldt	--	200	400
D Blue Lake	Humboldt	1,000	24,000	48,000
E Snow Camp	Humboldt	--	--	--
F Beaver	Humboldt	--	--	100
G Orick	Humboldt	100	200	600
H Big Lagoon	Humboldt	100	700	1,700
J Little River	Humboldt	100	500	1,300
Hydrographic Unit Total		1,300	25,700	52,400
Eel River Hydrographic Unit				
A Lake Pillsbury	Lake	--	--	--
	Mendocino	--	--	--
B Outlet Creek	Mendocino	1,000	2,400	5,000
C Willis Ridge	Mendocino	--	--	--
D Round Valley	Mendocino	200	600	2,000
E Wilderness	Mendocino	--	--	--
F Black Butte	Glenn	--	--	--
	Mendocino	--	--	--
G Etsel	Mendocino	--	--	--
H North Fork	Mendocino	--	--	--
J Bell Springs	Humboldt	--	--	--
	Mendocino	--	--	--
	Trinity	--	--	--

TABLE 102 (Continued)

Hydrographic unit/subunit	County	1960	1990	2020
Eel River Hydrographic Unit				
K Sequoia	Humboldt	--	--	--
	Trinity	--	--	--
L Yager Creek	Humboldt	--	--	--
M Van Duzen River	Humboldt	200	600	1,500
	Trinity	--	--	--
N Larabee Creek	Humboldt	--	--	--
P Laytonville	Mendocino	100	100	200
Q Lake Benbow	Humboldt	400	800	1,700
	Mendocino	100	500	1,200
R Humboldt Redwoods	Humboldt	300	700	1,200
S Lower Eel	Humboldt	2,900	24,900	50,100
T Eureka Plain	Humboldt	7,800	74,200	118,500
U Cape Mendocino	Humboldt	--	--	--
	Mendocino	--	--	--
Hydrographic Unit Total		13,000	104,800	181,400
Mendocino Coast H.U.				
A Rockport	Mendocino	--	100	100
B Fort Bragg	Mendocino	1,800	24,100	36,000
C Navarro River	Mendocino	100	200	300
D Point Arena	Mendocino	100	500	1,200
E Gualala River	Mendocino	--	300	400
	Sonoma	--	100	400
Hydrographic Unit Total		2,000	25,300	38,400
Russian River H.U.				
A Coyote Valley	Mendocino	100	300	600
B Forsythe Creek	Mendocino	500	2,100	4,300
C Upper Russian River	Mendocino	6,700	14,100	23,600
D Sulphur Creek	Sonoma	--	100	100
E Middle Russian River	Mendocino	--	--	--
	Sonoma	1,000	1,600	4,000
F Santa Rosa	Sonoma	5,800	19,100	37,900
G Laguna	Sonoma	5,000	18,100	32,900
H Mark West	Sonoma	600	9,700	18,700
J Dry Creek	Mendocino	--	--	--
	Sonoma	700	1,700	2,600
K Austin Creek	Sonoma	--	--	100
L Lower Russian River	Sonoma	800	1,800	2,400
M Bodega	Marin	--	--	--
	Sonoma	100	200	600
N Walker Creek	Sonoma	--	--	--
	Marin	--	600	1,600
Hydrographic Unit Total		21,300	69,400	129,400

Recreational Water Requirements

An area of special attractiveness, such as California's North Coast, may well anticipate and prepare for a vast influx of recreation seekers, for it is an area unique in many respects.

The enchanting redwood forests, the rushing rivers with their spectacular runs of salmon and steelhead, the inspiration of the rugged coastline, with cypress and pine forests marching down to the very edge of the cliffs, all combine to make the North Coast outstanding in recreational assets. To these assets, the future will see the addition of many reservoirs, most of them surrounded by impressive conifer forests, to add even greater attractions for the lover of the outdoors.

As in all projections of future development, some assumptions necessarily must be made in order to predict size and location of future recreation-associated water requirements. These assumptions relate to the length of work week, average number of vacation days, the means and ease of transportation, and among other things, even the desires of the future population. These projections should be considered, especially for 1990, as upper limits since the length of the work week is assumed to decrease and the number of vacations to increase at a much more rapid rate than in the recent past. This qualification also affects the projection for urban water use insofar as the economic base of the area consists of services to recreationists.

Amounts of annual recreation use of both day and overnight or vacation character, were projected for the years 1990 and 2020 by the State Department of Parks and Recreation under a contract with the Department of Water Resources.

Planning for the needs of the recreation seeker of the future leads us to consideration of recreational water requirements. This refers to water used by the visitor to the area at his camp, cabin, or motel, or used elsewhere in any manner for his basic needs. Not included in the concept of recreational water requirement is water to maintain fish flows in his favorite stream, or water in the lake he utilizes for water sports.

Although the water requirement in a given locality may not be relatively large, the existence of the demand very often has significant effects upon planning of water facilities.

Estimates of unit requirements were based upon experience gained at various units of the State Park System. The average delivery requirements for water per day for picnic use is 6 gallons per visitor-day, and for overnight or extended recreation use the requirement is 50 gallons per visitor-day. These unit requirements are not expected to change significantly.

The number of visitor-days projected for each subunit, applied to appropriate predicted rates of water use, result in the annual recreational water requirements shown in Tables 103 through 117.

TABLE 103

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 1990
TRINITY RIVER HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-4-A	Trinity Reservoir	170	34	17	17	17	17	17	17	341	375	375	307	1,704
F-4-B	Weaver Creek	15	3	1	1	1	1	1	1	30	33	33	27	147
F-4-C	Middle Trinity	30	6	3	3	3	3	3	3	59	65	65	53	296
F-4-D	Helena	41	8	4	4	4	4	4	4	81	90	90	73	407
F-4-E	New River													
F-4-F	Burnt Ranch	30	6	3	3	3	3	3	3	59	65	65	53	296
F-4-G	Hayfork Valley													
F-4-H	Hayfork Creek													
F-4-J	Upper South Fork													
F-4-K	Hyampom	19	4	2	2	2	2	2	2	37	41	41	33	187
F-4-L	Lower South Fork	11	2	1	1	1	1	1	1	22	24	24	20	10[illegible]
F-4-M	Willow Creek	15	3	1	1	1	1	1	1	30	33	33	27	147
F-4-N	Hoopa	41	8	4	4	4	4	4	4	81	90	90	73	407
	TOTAL	372	74	36	36	36	36	36	36	740	816	816	666	3,700

TABLE 104

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 2020
TRINITY RIVER HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-Feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-4-A	Trinity Reservoir	654	131	65	65	65	65	65	65	1,308	1,439	1.439	1 177	6,538
F-4-B	Weaver Creek	57	11	6	6	6	6	6	6	114	125	125	102	570
F-4-C	Middle Trinity	114	23	11	11	11	11	11	11	228	250	250	205	1.136
F-4-D	Helena	156	31	16	16	16	16	16	16	313	344	344	281	1,565
F-4-E	New River													
F-4-F	Burnt Ranch	114	23	11	11	11	11	11	11	228	250	250	205	1,136
F-4-G	Hayfork Valley													
F-4-H	Hayfork Creek													
F-4-J	Upper South Fork													
F-4-K	Hyampom	71	14	7	7	7	7	7	7	142	156	156	128	709
F-4-L	Lower South Fork	43	9	4	4	4	4	4	4	85	94	94	77	426
F-4-M	Willow Creek	57	11	6	6	6	6	6	6	114	125	125	102	570
F-4-N	Hoopa	156	31	16	16	16	16	16	16	313	344	344	281	1,565
	TOTAL	1,422	284	142	142	142	142	142	142	2,845	3,127	3,127	2,558	14,215

TABLE 105

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 1990
MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-Feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-5-A	Ruth	2	1	1	1	1	1	1	1	4	5	5	4	27
F-5-B	Butler Valley	1	1	1	1	1	1	1	1	1	1	1	1	12
F-5-C	North Fork													
F-5-D	Blue Lake	1	1	1	1	1	1	1	1	1	1	1	1	12
F-5-E	Snow Camp													
F-5-F	Beaver													
F-5-G	Orick	7	1	1	1	1	1	1	1	14	16	16	13	73
F-5-H	Big Lagoon	7	1	1	1	1	1	1	1	14	16	16	13	73
F-5-J	Little River	2	1	1	1	1	1	1	1	4	5	5	4	27
	TOTAL	20	6	6	6	6	6	6	6	38	44	44	36	224

TABLE 106

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 2020
MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-Feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-5-A	Ruth	9	2	1	1	1	1	1	1	17	19	19	16	38
F-5-B	Butler Valley	3	1	1	1	1	1	1	1	6	6	6	5	33
F-5-C	North Fork													
F-5-D	Blue Lake	3	1	1	1	1	1	1	1	6	6	6	5	33
F-5-E	Snow Camp	1	1	1	1	1	1	1	1	1	1	1	1	12
F-5-F	Beaver	1	1	1	1	1	1	1	1	1	1	1	1	12
F-5-G	Orick	28	6	3	3	3	3	3	3	55	61	61	50	279
F-5-H	Big Lagoon	28	6	3	3	3	3	3	3	55	61	61	50	279
F-5-J	Little River	9	2	1	1	1	1	1	1	17	19	19	16	88
	TOTAL	82	20	12	12	12	12	12	12	158	174	174	144	824

TABLE 107

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 1990
EEL RIVER HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-Feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-6-A	Lake Pillsbury	31	6	3	3	3	3	3	3	63	69	69	57	313
F-6-B	Outlet Creek	3	1	1	1	1	1	1	1	6	7	7	6	36
F-6-C	Willis Ridge	44	9	4	4	4	4	4	4	88	97	97	79	438
F-6-D	Round Valley	9	2	1	1	1	1	1	1	19	21	21	17	95
F-6-E	Wilderness	16	3	2	2	2	2	2	2	31	35	35	28	160
F-6-F	Black Butte													
F-6-G	Etsel	31	6	3	3	3	3	3	3	63	69	69	57	313
F-6-H	North Fork													
F-6-J	Bell Springs	31	6	3	3	3	3	3	3	63	69	69	57	313
F-6-K	Sequoia	44	9	4	4	4	4	4	4	88	97	97	79	438
F-6-L	Yager Creek													
F-6-M	Van Duzen River	44	9	4	4	4	4	4	4	88	97	97	79	438
F-6-N	Larabee Creek	16	3	2	2	2	2	2	2	31	35	35	28	160
F-6-P	Laytonville													
F-6-Q	Lake Benbow	120	24	12	12	12	12	12	12	239	263	263	215	1,196
F-6-R	Humboldt-Redwoods	151	30	15	15	15	15	15	15	302	332	332	272	1,509
F-6-S	Lower Eel	44	9	4	4	4	4	4	4	88	97	97	79	438
F-6-T	Eureka Plain	13	3	1	1	1	1	1	1	25	28	28	23	126
F-6-U	Cape Mendocino	31	6	3	3	3	3	3	3	63	69	69	57	313
	TOTAL	628	126	62	62	62	62	62	62	1,257	1,385	1,385	1,133	6,286

TABLE 108

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 2020
EEL RIVER HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-6-A	Lake Pillsbury	119	24	12	12	12	12	12	12	239	263	263	215	1,195
F-6-B	Outlet Creek	12	3	1	1	1	1	1	1	24	26	26	21	118
F-6-C	Willis Ridge	167	33	17	17	17	17	17	17	334	368	368	301	1,673
F-6-D	Round Valley	36	7	4	4	4	4	4	4	72	79	79	64	361
F-6-E	Wilderness	60	12	6	6	6	6	6	6	119	131	131	107	596
F-6-F	Black Butte													
F-6-G	Etsel	119	24	12	12	12	12	12	12	239	263	263	215	1,195
F-6-H	North Fork													
F-6-J	Bell Springs	119	24	12	12	12	12	12	12	239	263	263	215	1,195
F-6-K	Sequoia	167	33	17	17	17	17	17	17	334	368	368	301	1,673
F-6-L	Yager Creek													
F-6-M	Van Duzen River	167	33	17	17	17	17	17	17	334	368	368	301	1,673
F-6-N	Larabee Creek	60	12	6	6	6	6	6	6	119	131	131	107	596
F-6-P	Laytonville													
F-6-Q	Lake Benbow	454	91	45	45	45	45	45	45	908	998	998	817	4,536
F-6-R	Humboldt Redwoods	573	115	57	57	57	57	57	57	1,146	1,261	1,261	1,032	5,730
F-6-S	Lower Eel	167	33	17	17	17	17	17	17	334	368	368	301	1,673
F-6-T	Eureka Plain	48	10	5	5	5	5	5	5	96	105	105	86	480
F-6-U	Cape Mendocino	119	24	12	12	12	12	12	12	239	263	263	215	1,195
	TOTAL	2,387	478	240	240	240	240	240	240	4,776	5,255	5,255	4,298	23,889

TABLE 109

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 1990
MENDOCINO COAST HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-Feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-8-A	Rockport	8	2	1	1	1	1	1	1	16	18	18	15	83
F-8-B	Fort Bragg	22	5	2	2	2	2	2	2	43	48	48	39	217
F-8-C	Navarro River	8	2	1	1	1	1	1	1	16	18	18	15	83
F-8-D	Point Arena	75	15	8	8	8	8	8	8	149	164	164	135	750
F-8-E	Gualala River	54	12	5	5	5	5	5	5	107	117	117	96	533
	TOTAL	167	36	17	17	17	17	17	17	331	365	365	300	1,666

TABLE 110

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 2020
MENDOCINO COAST HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-Feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-8-A	Rockport	22	4	2	2	2	2	2	2	43	47	47	39	214
F-8-B	Fort Bragg	56	11	6	6	6	6	6	6	112	123	123	101	562
F-8-C	Navarro River	22	4	2	2	2	2	2	2	43	47	47	39	214
F-8-D	Point Arena	194	39	19	19	19	19	19	19	387	426	426	349	1,935
F-8-E	Gualala River	138	28	14	14	14	14	14	14	275	303	303	248	1,379
	TOTAL	432	86	43	43	43	43	43	43	860	946	946	776	4,304

TABLE 111

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 1990
RUSSIAN RIVER HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-9-A	Coyote Valley													
F-9-B	Forsythe Creek	2	1	1	1	1	1	1	1	3	3	3	3	21
F-9-C	Upper Russian	2	1	1	1	1	1	1	1	3	3	3	3	21
F-9-D	Sulphur Creek													
F-9-E	Middle Russian	6	1	1	1	1	1	1	1	12	13	13	11	62
F-9-F	Santa Rosa													
F-9-G	Laguna													
F-9-H	Mark West	2	1	1	1	1	1	1	1	3	3	3	3	21
F-9-J	Dry Creek	2	1	1	1	1	1	1	1	3	3	3	3	21
F-9-K	Austin Creek	41	8	4	4	4	4	4	4	82	91	91	74	411
F-9-L	Lower Russian	100	20	10	10	10	10	10	10	200	220	220	180	1,000
F-9-M	Bodega	71	14	7	7	7	7	7	7	141	155	155	127	705
F-9-N	Walker Creek	71	14	7	7	7	7	7	7	141	155	155	127	705
	TOTAL	297	61	33	33	33	33	33	33	588	646	646	531	2,967

TABLE 112

ESTIMATED MONTHLY WATER DELIVERY FOR
RECREATIONAL USE IN 2020
RUSSIAN RIVER HYDROGRAPHIC UNIT

Subunit		Required Water Delivery in Acre-feet												
Number	Name	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
F-9-A	Coyote Valley													
F-9-B	Forsythe Creek	4	1	1	1	1	1	1	1	8	9	9	7	44
F-9-C	Upper Russian	4	1	1	1	1	1	1	1	8	9	9	7	44
F-9-D	Sulphur Creek													
F-9-E	Middle Russian	16	3	2	2	2	2	2	2	32	35	35	29	162
F-9-F	Santa Rosa													
F-9-G	Laguna													
F-9-H	Mark West	4	1	1	1	1	1	1	1	8	9	9	7	44
F-9-J	Dry Creek	4	1	1	1	1	1	1	1	8	9	9	7	44
F-9-K	Austin Creek	113	23	11	11	11	11	11	11	226	248	248	203	1,127
F-9-L	Lower Russian	274	55	27	27	27	27	27	27	548	603	603	493	2,738
F-9-M	Bodega	194	39	19	19	19	19	19	19	387	426	426	348	1,934
F-9-N	Walker Creek	194	39	19	19	19	19	19	19	387	426	426	348	1,934
	TOTAL	807	163	82	82	82	82	82	82	1,612	1,774	1,774	1,449	8,071

TABLE 113

ESTIMATED ANNUAL RECREATIONAL USE AND WATER REQUIREMENT
1990 AND 2020
TRINITY RIVER HYDROGRAPHIC UNIT

Subunit		1990			2020		
		Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet	Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet
Reference Number	Name	Day Use	Overnight Use		Day Use	Overnight Use	
F-4-A	Trinity Reservoir	863	10,993	1,704	3,836	42,164	6,538
F-4-B	Weaver Creek	75	956	147	334	3,666	570
F-4-C	Middle Trinity	150	1,912	296	667	7,333	1,136
F-4-D	Helena	206	2,628	407	917	10,083	1,565
F-4-E	New River	-0-	-0-		-0-	-0-	
F-4-F	Burnt Ranch	150	1,912	296	667	7,333	1,136
F-4-G	Hayfork Valley	-0-	-0-		-0-	-0-	
F-4-H	Hayfork Creek	-0-	-0-		-0-	-0-	
F-4-J	Upper South Fork	-0-	-0-		-0-	-0-	
F-4-K	Hyampom	94	1,195	187	417	4,583	709
F-4-L	Lower South Fork	56	717	109	250	2,750	426
F-4-M	Willow Creek	75	956	147	334	3,666	570
F-4-N	Hoopa	206	2,628	407	917	10,083	1,565
	TOTAL	1,875	23,897	3,700	8,339	91,661	14,215

TABLE 114

ESTIMATED ANNUAL RECREATIONAL USE AND WATER REQUIREMENT
1990 AND 2020
MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

Subunit		1990			2020		
Reference Number	Name	Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet	Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet
		Day Use	Overnight Use		Day Use	Overnight Use	
F-5-A	Ruth	114	133	27	508	503	88
F-5-B	Butler Valley	36	42	12	161	160	33
F-5-C	North Fork						
F-5-D	Blue Lake	36	42	12	161	160	33
F-5-E	Snow Camp	5	6		23	23	12
F-5-F	Beaver	5	6		23	23	12
F-5-G	Orick	361	426	73	1,615	1,602	279
F-5-H	Big Lagoon	362	425	73	1,615	1,602	279
F-5-J	Little River	114	133	27	508	503	88
	TOTAL	1,033	1,213	224	4,614	4,576	824

TABLE 115

ESTIMATED ANNUAL RECREATIONAL USE AND WATER REQUIREMENT
1990 AND 2020
EEL RIVER HYDROGRAPHIC UNIT

Subunit		1990			2020		
Reference Number	Name	Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet	Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet
		Day Use	Overnight Use		Day Use	Overnight Use	
F-6-A	Lake Pillsbury	211	2,024	313	943	7,670	1,195
F-6-B	Outlet Creek	21	202	36	94	767	118
F-6-C	Willis Ridge	296	2,833	438	1,320	10,737	1,673
F-6-D	Round Valley	63	607	95	283	2,301	361
F-6-E	Wilderness	106	1,012	160	472	3,835	596
F-6-F	Black Butte	-0-	-0-				
F-6-G	Etsel	211	2,023	313	944	7,669	1,195
F-6-H	North Fork	-0-	-0-				
F-6-J	Bell Springs	212	2,023	313	944	7,669	1,195
F-6-K	Sequoia	296	2,833	438	1,320	10,727	1,673
F-6-L	Yager Creek	-0-	-0-				
F-6-M	Van Duzen River	296	2,833	438	1,320	10,727	1,673
F-6-N	Larabee Creek	106	1,012	160	472	3,835	596
F-6-P	Laytonville	-0-	-0-				
F-6-Q	Lake Benbow	803	7,689	1,196	3,584	29,144	4,536
F-6-R	Humboldt Redwoods	1,015	9,713	1,509	4,528	36,814	5,730
F-6-S	Lower Eel	296	2,833	438	1,320	10,737	1,673
F-6-T	Eureka Plain	85	809	126	377	3,068	480
F-6-U	Cape Mendocino	211	2,024	313	944	7,670	1,195
	TOTAL	4,228	40,047	6,286	18,865	153,370	23,889

TABLE 116

ESTIMATED ANNUAL RECREATIONAL USE AND WATER REQUIREMENT
1990 AND 2020
MENDOCINO COAST HYDROGRAPHIC UNIT

Subunit		1990			2020		
		Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet	Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet
Reference Number	Name	Day Use	Overnight Use		Day Use	Overnight Use	
F-8-A	Rockport	290	508	83	1,354	1,239	214
F-8-B	Fort Bragg	754	1,322	217	3,520	3,222	562
F-8-C	Navarro River	290	508	83	1,354	1,239	214
F-8-D	Point Arena	2,609	4,575	750	12,186	11,156	1,935
F-8-E	Gualala River	1,856	3,253	533	8,665	7,932	1,379
	TOTAL	5,799	10,166	1,666	27,079	24,788	4,304

TABLE 117

ESTIMATED ANNUAL RECREATIONAL USE AND WATER REQUIREMENT
1990 AND 2020
RUSSIAN RIVER HYDROGRAPHIC UNIT

Subunit		1990			2020		
Reference Number	Name	Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet	Recreation Use in Thousands of Visitor-Days		Water Requirement in Acre-feet
		Day Use	Overnight Use		Day Use	Overnight Use	
F-9-A	Coyote Valley						
F-9-B	Forsythe Creek	30	92	21	117	249	44
F-9-C	Upper Russian	30	92	21	117	249	44
F-9-D	Sulphur Creek						
F-9-E	Middle Russian	122	369	62	469	995	162
F-9-F	Santa Rosa						
F-9-G	Laguna						
F-9-H	Mark West	30	92	21	117	248	44
F-9-J	Dry Creek	30	92	21	119	248	44
F-9-K	Austin Creek	847	2,583	411	3,281	6,962	1,127
F-9-L	Lower Russian	2,058	6,273	1,000	7,969	16,907	2,738
F-9-M	Bodega	1,452	4,428	705	5,625	11,934	1,934
F-9-N	Walker Creek	1,452	4,428	705	5,625	11,934	1,934
	TOTAL	6,051	18,449	2,967	23,439	49,726	8,071

Water sports and golf course at Lake Benbow

Camping at Richardson Grove, California State Park. (Photograph by Division of Beaches and Parks.)

Summary of Future Water Requirements

This section summarizes the annual water requirements for agricultural, municipal and industrial, and recreational purposes which were developed earlier in this chapter. It also develops and applies monthly distributional factors to these water requirements, and indicates net water use necessary to determine water surplus or deficiency. It summarizes results of studies by the California Department of Fish and Game recommending average streamflow requirements at downstream subunit boundaries necessary to maintain historic average fish populations.

Monthly Distribution of Water Requirements

As shown in the previous chapter, the natural monthly distribution of runoff within the study area is subject to wide variation. Summer month flows, are in many cases, much lower than the average or mean seasonal flows. It is characteristic of this study area, as in all of California, that these months of low runoff are those which experience the highest demand for water. In order to evaluate more completely the water requirements, surplus or deficiency, and to indicate the approximate magnitude of streamflow regulation necessary to provide for these local requirements, monthly demand schedules were developed and applied to the previously derived annual water requirements. These demand schedules, expressed as monthly percentages of the total annual water requirements are shown in Tables 118, 119, and 120.

TABLE 118

ESTIMATED MONTHLY DISTRIBUTION OF
RECREATIONAL WATER REQUIREMENTS

(In Percent of Seasonal Total)

Month	Percent	Month	Percent
January	1	July	22
February	1	August	22
March	1	September	18
April	1	October	10
May	1	November	2
June	20	December	1

Net Use

"Net use" in Table 121 refers to the difference between the total water applied or "diverted" in a subunit and the portion of this diverted flow that will return to the stream for reuse in downstream subunits. The determination of net use was based upon assumed application efficiencies which reflect the ratio of water consumed to water applied for specific purposes. For subunits draining directly into the ocean, the diverted and net use values were assumed to be equal, since the amounts of water diverted, in the most part, would become an irrecoverable loss to the ocean.

Fish and Wildlife Water Requirements

In the process of determining present and future water requirements of an area, it is state policy to consider the amounts of water necessary to maintain, and if possible, enhance, fish and wildlife resources as a beneficial use of water. Therefore, the Department of Water Resources entered a contract with the Department of

Fish and Game to evaluate the streamflows required to maintain fish and wildlife population at present levels for each hydrographic subunit with the study area. This information has been abstracted from Appendix C to Bulletin No. 136, "North Coastal Area Investigation," and is summarized in Tables 124 through 128 in this report.

In determining the amounts of surplus or deficiency available within each stream group or stream basin, this investigation has made full allowances for the fish and wildlife maintenance water requirements recommended by the Department of Fish and Game.

TABLE 119

ESTIMATED MONTHLY DISTRIBUTION OF
MUNICIPAL AND INDUSTRIAL WATER DEMAND

(Percent of Annual Total)

Hydrographic Subunit	Reference Number Plate 2	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						Trinity Hydrographic Unit							
Trinity Reservoir	F-4-A	5	4	4	5	6	10	15	17	14	8	7	5
Weaver Creek	F-4-B	5	4	4	5	6	10	15	17	14	8	7	5
Middle Trinity	F-4-C	5	4	4	5	6	10	15	17	14	8	7	5
Helena	F-4-D	5	4	4	5	6	10	15	17	14	8	7	5
New River	F-4-E	5	4	4	5	6	10	15	17	14	8	7	5
Burnt Ranch	F-4-F	5	4	4	5	6	10	15	17	14	8	7	5
Hayfork Valley	F-4-G	5	4	4	5	6	10	15	17	14	8	7	5
Hayfork Creek	F-4-H	5	4	4	5	6	10	15	17	14	8	7	5
Upper South Fork	F-4-J	5	5	5	6	10	13	14	12	9	8	7	6
Hyampom	F-4-K	5	5	5	6	10	13	14	12	9	8	7	6
Lower South Fork	F-4-L	5	5	5	6	10	13	14	12	9	8	7	6
Willow Creek	F-4-M	5	5	5	6	10	13	14	12	9	8	7	6
Hoopa	F-4-N	5	5	5	6	10	13	14	12	9	8	7	6

TABLE 119 (Continued)

ESTIMATED MONTHLY DISTRIBUTION OF
MUNICIPAL AND INDUSTRIAL WATER DEMAND

(Percent of Annual Total)

Hydrographic Subunit	Reference Number Plate 2	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mad River-Redwood Creek Hydrographic Unit													
Ruth	F-5-A	7	7	7	7	8	10	12	11	9	8	7	7
Butler Valley	F-5-B	7	7	7	7	8	10	12	11	9	8	7	7
North Fork	F-5-C	7	7	7	7	8	10	12	11	9	8	7	7
Blue Lake	F-5-D												
1960 thru 1970		7	7	7	7	8	10	12	11	9	8	7	7
1980 thru 2020		8	8	8	8	8	9	9	9	9	8	8	8
Snow Camp	F-5-E	-	-	-	-	-	-	-	-	-	-	-	-
Beaver	F-5-F	7	7	7	7	8	10	12	11	9	8	7	7
Orick	F-5-G	7	7	7	7	8	10	12	11	9	8	7	7
Big Lagoon	F-5-H	7	7	7	7	8	10	12	11	9	8	7	7
Little River	F-5-J	7	7	7	7	8	10	12	11	9	8	7	7

TABLE 119 (Continued)

ESTIMATED MONTHLY DISTRIBUTION OF
MUNICIPAL AND INDUSTRIAL WATER DEMAND

(Percent of Annual Total)

Hydrographic Subunit	Reference Number Plate 2	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Eel River Hydrographic Unit													
Outlet Creek	F-6-B	6	6	6	7	8	9	13	13	11	8	7	6
Round Valley	F-6-D	6	6	6	7	8	9	13	13	11	8	7	6
Van Duzen River	F-6-M	7	7	7	7	8	10	12	11	9	8	7	7
Laytonville	F-6-P	6	6	6	7	8	9	13	13	11	8	7	6
Lake Benbow	F-6-Q	7	7	7	7	8	10	12	11	9	8	7	7
Humboldt Redwoods	F-6-R	7	7	7	7	8	10	12	11	9	8	7	7
Lower Eel	F-6-S												
1960 thru 1980		7	7	7	7	8	10	12	11	9	8	7	7
1990 thru 2020		8	7	8	8	9	9	9	9	9	9	7	8
Eureka Plain	F-6-T												
1960		7	7	7	7	8	10	12	11	9	8	7	7
1970 thru 2020		8	7	8	8	9	9	9	9	9	9	7	8

TABLE 119 (Continued)

ESTIMATED MONTHLY DISTRIBUTION OF MUNICIPAL AND INDUSTRIAL WATER DEMAND

(Percent of Annual Total)

Hydrographic Subunit	Reference Number Plate 2	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mendocino Coast Hydrographic Unit													
Rockport	F-8-A	7	7	6	8	9	11	11	10	9	8	7	7
Fort Bragg	F-8-B												
1960 thru 1970		7	7	6	8	9	11	11	10	9	8	7	7
1980 thru 2020		8	8	7	8	9	9	9	9	9	8	8	8
Navarro River	F-8-C	7	7	7	7	8	10	12	11	9	8	7	7
Point Arena	F-8-D	7	7	6	8	9	11	11	10	9	8	7	7
Gualala River	F-8-E	7	7	6	8	9	11	11	10	9	8	7	7

TABLE 119 (Continued)

ESTIMATED MONTHLY DISTRIBUTION OF
MUNICIPAL AND INDUSTRIAL WATER DEMAND

(Percent of Annual Total)

Hydrographic Subunit	Reference Number Plate 2	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
					Russian River Hydrographic Unit								
Coyote Valley	F-9-A	4	4	4	5	7	11	16	17	12	8	7	5
Forsythe Creek	F-9-B	5	5	5	6	10	13	14	12	9	8	7	6
Upper Russian	F-9-C	4	4	4	5	6	11	17	18	12	8	6	5
Sulphur Creek	F-9-D	5	5	5	6	10	13	14	12	9	8	7	6
Middle Russian	F-9-E	5	5	5	6	10	13	14	12	9	8	7	6
Santa Rosa	F-9-F	5	5	5	6	10	13	14	12	9	8	7	6
Laguna	F-9-G	5	5	5	6	10	13	14	12	9	8	7	6
Mark West	F-9-H	5	5	5	6	10	13	14	12	9	8	7	6
Dry Creek	F-9-J	5	5	5	6	10	13	14	12	9	8	7	6
Austin Creek	F-9-K	7	7	7	7	8	10	12	11	9	8	7	7
Lower Russian	F-9-L	7	7	7	7	8	10	12	11	9	8	7	7
Bodega	F-9-M	7	7	7	7	8	10	12	11	9	8	7	7
Walker Creek	F-9-N	7	7	7	7	8	10	12	11	9	8	7	7

TABLE 120

ESTIMATED MONTHLY DISTRIBUTION OF IRRIGATION DEMAND

(Percent of Annual Total)

Hydrographic Subunit	Reference Number Plate 2	Apr.	May	June	July	Aug.	Sept.	Oct.
Mad River-Redwood Creek Hydrographic Unit								
Ruth	F-5-A	-	9	21	27	24	19	-
Butler Valley	F-5-B	-	9	21	27	24	19	-
North Fork	F-5-C	-	9	21	27	24	19	-
Blue Lake	F-5-D	-	6	16	35	33	10	-
Snow Camp	F-5-E	-	9	21	27	24	19	-
Beaver	F-5-F	-	9	21	27	24	19	-
Orick	F-5-G	-	6	16	35	33	10	-
Big Lagoon	F-5-H	-	6	16	35	33	10	-
Little River	F-5-J	-	6	16	35	33	10	-
Trinity River Hydrographic Unit								
All subunits		-	9	21	27	24	19	-
Eel River Hydrographic Unit								
Lake Pillsbury	F-6-A	-	9	21	27	24	19	-
Outlet Creek	F-6-B	-	8	24	28	22	18	-
Willis Ridge	F-6-C	-	9	21	27	24	19	-
Round Valley	F-6-D	-	8	24	28	22	18	-
Wilderness	F-6-E	-	-	-	-	-	-	-
Black Butte	F-6-F	-	9	21	27	24	19	-
Etsel	F-6-G	-	9	21	27	24	19	-
North Fork	F-6-H	-	9	21	27	24	19	-
Bell Springs	F-6-J	-	9	21	27	24	19	-
Sequoia	F-6-K	-	9	21	27	24	19	-
Yager Creek	F-6-L	-	9	21	27	24	19	-
Van Duzen River	F-6-M	-	6	16	35	33	10	-
Larabee Creek	F-6-N	-	9	21	27	24	19	-
Laytonville	F-6-P	-	8	24	28	22	18	-
Lake Benbow	F-6-Q	-	9	21	27	24	19	
Humboldt Redwoods	F-6-R	-	6	16	35	33	10	-
Lower Eel	F-6-S	-	6	16	35	33	10	-
Eureka Plain	F-6-T	-	6	16	35	33	10	-
Cape Mendocino	F-6-U	-	8	24	28	22	18	-

TABLE 120 (Continued)

Hydrographic Subunit	Reference Number Plate 2	Apr.	May	June	July	Aug.	Sept.	Oct.
Mendocino Coast Hydrographic Unit								
Rockport	F-8-A	-	6	16	35	33	10	-
Fort Bragg	F-8-B	-	6	16	35	33	10	-
Navarro River	F-8-C	-	8	24	28	22	18	-
Point Arena	F-8-D	-	6	16	35	33	10	-
Gualala River	F-8-E	-	6	16	35	33	10	-
Russian River Hydrographic Unit								
Bodega	F-9-M	-	6	16	35	33	10	-
Walker Creek	F-9-N	-	6	16	35	33	10	-
All remaining subunits		3	12	25	30	18	12	-

TABLE 121

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		Annual				October				November				December				January				February				March			
		Farm Irrigation	Municipal and Industrial	Recreational	Total	Farm Irrigation	Municipal and Industrial	Recreational	Total	Farm Irrigation	Municipal and Industrial	Recreational	Total	Farm Irrigation	Municipal and Industrial	Recreational	Total	Farm Irrigation	Municipal and Industrial	Recreational	Total	Farm Irrigation	Municipal and Industrial	Recreational	Total	Farm Irrigation	Municipal and Industrial	Recreational	Total
TRINITY RIVER HYDROGRAPHIC UNIT (1990)																													
A Trinity Reservoir	Diverted	1,390	400	1,704	3,494	-	32	170	202	-	28	34	62	-	20	17	37	-	20	17	37	-	16	17	33	-	16	17	33
	Net Use	903	160	-	1,063	-	13	-	13	-	11	-	11	-	8	-	8	-	8	-	8	-	6	-	6	-	6	-	6
B Weaver Creek	Diverted	700	1,000	147	1,847	-	80	15	95	-	70	3	73	-	50	1	51	-	50	1	51	-	40	1	41	-	40	1	41
	Net Use	455	400	-	855	-	32	-	32	-	28	-	28	-	20	-	20	-	20	-	20	-	16	-	16	-	16	-	16
C Middle Trinity	Diverted	2,750	200	296	3,246	-	16	30	46	-	14	6	20	-	10	3	13	-	10	3	13	-	8	3	11	-	8	3	11
	Net Use	1,787	80	-	1,867	-	6	-	6	-	6	-	6	-	4	-	4	-	4	-	4	-	3	-	3	-	3	-	3
D Helena	Diverted	110	100	407	617	-	8	41	49	-	7	8	15	-	5	4	9	-	5	4	9	-	4	4	8	-	4	4	8
	Net Use	72	40	-	112	-	3	-	3	-	3	-	3	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
E New River	Diverted	470	-	-	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	306	-	-	306	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F Burnt Ranch	Diverted	1,490	300	296	2,086	-	24	30	54	-	21	6	27	-	15	3	18	-	15	3	18	-	12	3	15	-	12	3	15
	Net Use	968	120	-	1,088	-	10	-	10	-	8	-	8	-	6	-	6	-	6	-	6	-	5	-	5	-	5	-	5
G Hayfork Valley	Diverted	13,520	900	-	14,420	-	72	-	72	-	63	-	63	-	45	-	45	-	45	-	45	-	36	-	36	-	36	-	36
	Net Use	8,788	360	-	9,148	-	29	-	29	-	25	-	25	-	18	-	18	-	18	-	18	-	14	-	14	-	14	-	14
H Hayfork Creek	Diverted	1,340	-	-	1,340	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	871	-	-	871	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J Upper South Fork	Diverted	950	-	-	950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	618	-	-	618	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K Hyampom	Diverted	1,550	100	187	1,837	-	8	19	27	-	7	4	11	-	6	2	8	-	5	2	7	-	5	2	7	-	5	2	7
	Net Use	1,007	40	-	1,047	-	3	-	3	-	3	-	3	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
L Lower South Fork	Diverted	950	-	109	1,059	-	-	11	11	-	-	2	2	-	-	1	1	-	-	1	1	-	-	1	1	-	-	1	1
	Net Use	618	-	-	618	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M Willow Creek	Diverted	2,210	200	147	2,557	-	16	15	31	-	14	3	17	-	12	1	13	-	10	1	11	-	10	1	11	-	10	1	11
	Net Use	1,436	80	-	1,516	-	6	-	6	-	6	-	6	-	5	-	5	-	4	-	4	-	4	-	4	-	4	-	4
N Hoopa	Diverted	4,110	600	407	5,117	-	48	41	89	-	42	8	50	-	36	4	40	-	30	4	34	-	30	4	34	-	30	4	34
	Net Use	2,672	240	-	2,912	-	19	-	19	-	17	-	17	-	14	-	14	-	12	-	12	-	12	-	12	-	12	-	12
Hydrographic Unit Totals	Diverted	31,540	3,800	3,700	39,040	-	304	372	676	-	266	74	340	-	199	36	235	-	190	36	226	-	161	36	197	-	161	36	197
	Net Use	20,501	1,520	-	22,021	-	121	-	121	-	107	-	107	-	79	-	79	-	76	-	76	-	64	-	64	-	64	-	64

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		April				May				June				July				August				September			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
THINITY RIVER HYDROGRAPHIC UNIT (1990) (Continued)																									
A Trinity Reservoir	Diverted	-	20	17	37	125	24	17	166	292	40	341	673	375	60	375	810	334	68	375	777	264	56	307	627
	Net Use	-	8	-	8	81	10	-	91	190	16	-	206	243	24	-	267	217	28	-	245	172	22	-	194
B Weaver Creek	Diverted	-	50	1	51	63	60	1	124	147	100	30	277	189	150	33	372	168	170	33	371	133	140	27	300
	Net Use	-	20	-	20	41	24	-	65	96	40	-	136	123	60	-	183	109	68	-	177	86	56	-	142
C Middle Trinity	Diverted	-	10	3	13	248	12	3	263	578	20	59	657	742	30	65	837	660	34	65	759	522	28	53	603
	Net Use	-	4	-	4	161	5	-	166	376	8	-	384	482	12	-	494	429	14	-	443	339	11	-	350
D Helena	Diverted	-	5	4	9	10	6	4	20	23	10	81	114	30	15	90	135	26	17	90	133	21	14	73	108
	Net Use	-	2	-	2	7	2	-	9	15	4	-	19	19	6	-	25	17	7	-	24	14	5	-	19
E New River	Diverted	-	-	-	-	42	-	-	42	99	-	-	99	127	-	-	127	113	-	-	113	89	-	-	89
	Net Use	-	-	-	-	27	-	-	27	64	-	-	64	84	-	-	84	73	-	-	73	58	-	-	58
F Burnt Ranch	Diverted	-	15	3	18	134	18	3	155	313	30	59	402	402	45	65	512	358	51	65	474	283	42	53	378
	Net Use	-	6	-	6	87	7	-	94	203	12	-	215	261	18	-	279	233	20	-	253	184	17	-	201
G Hayfork Valley	Diverted	-	45	-	45	1,217	54	-	1,271	2,839	90	-	2,929	3,650	135	-	3,785	3,245	153	-	3,398	2,569	126	-	2,695
	Net Use	-	18	-	18	791	22	-	813	1,845	36	-	1,881	2,373	55	-	2,428	2,109	61	-	2,170	1,670	50	-	1,720
H Hayfork Creek	Diverted	-	-	-	-	121	-	-	121	281	-	-	281	362	-	-	362	322	-	-	322	254	-	-	254
	Net Use	-	-	-	-	79	-	-	79	183	-	-	183	235	-	-	235	209	-	-	209	165	-	-	165
J Upper South Fork	Diverted	-	-	-	-	86	-	-	86	199	-	-	199	257	-	-	257	228	-	-	228	180	-	-	180
	Net Use	-	-	-	-	56	-	-	56	129	-	-	129	168	-	-	168	148	-	-	148	117	-	-	117
K Hyampom	Diverted	-	6	2	8	139	10	2	151	326	13	37	376	419	14	41	474	372	12	41	425	294	9	33	336
	Net Use	-	2	-	2	90	4	-	94	212	5	-	217	272	6	-	278	242	5	-	247	191	4	-	195
L Lower South Fork	Diverted	-	-	1	1	86	-	1	87	199	-	22	221	256	-	24	280	228	-	24	252	181	-	20	201
	Net Use	-	-	-	-	56	-	-	56	129	-	-	129	167	-	-	167	148	-	-	148	118	-	-	118
M Willow Creek	Diverted	-	12	1	13	199	20	1	220	464	26	30	520	597	28	33	658	530	24	33	587	420	18	27	465
	Net Use	-	5	-	5	129	8	-	137	302	10	-	312	388	11	-	399	344	10	-	354	273	7	-	280
N Hoopa Valley	Diverted	-	36	4	40	370	60	4	434	863	78	81	1,022	1,110	84	90	1,284	986	72	90	1,148	781	54	73	908
	Net Use	-	14	-	14	241	24	-	265	561	31	-	592	721	34	-	755	641	29	-	670	508	22	-	530
Hydrographic Unit Totals	Diverted	-	199	36	235	2,840	264	36	3,140	6,623	407	740	7,770	8,516	561	816	9,893	7,570	601	816	8,987	5,991	487	666	7,144
	Net Use	-	79	-	79	1,846	106	-	1,952	4,305	162	-	4,467	5,536	226	-	5,762	4,919	242	-	5,161	3,895	194	-	4,089

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		Annual				October				November				December				January				February				March			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
TRINITY RIVER HYDROGRAPHIC UNIT (2020)																													
A Trinity Reservoir	Diverted	1,790	700	6,538	9,028	-	56	654	710	-	49	131	180	-	35	65	100	-	35	65	100	-	28	65	93	-	28	65	93
	Net Use	1,164	280	-	1,444	-	22	-	22	-	20	-	20	-	14	-	14	-	14	-	14	-	11	-	11	-	11	-	11
B Weaver Creek	Diverted	930	1,500	570	3,000	-	120	57	177	-	105	11	116	-	75	6	81	-	75	6	81	-	60	6	66	-	60	6	66
	Net Use	605	600	-	1,205	-	48	-	48	-	42	-	42	-	30	-	30	-	30	-	30	-	24	-	24	-	24	-	24
C Middle Trinity	Diverted	3,490	400	1,136	5,026	-	32	114	146	-	28	23	51	-	20	11	31	-	20	11	31	-	16	11	27	-	16	11	27
	Net Use	2,268	160	-	2,428	-	13	-	13	-	11	-	11	-	8	-	8	-	8	-	8	-	6	-	6	-	6	-	6
D Helena	Diverted	110	200	1,565	1,875	-	16	156	172	-	14	31	45	-	10	16	26	-	10	16	26	-	8	16	24	-	8	16	24
	Net Use	72	80	-	152	-	6	-	6	-	6	-	6	-	4	-	4	-	4	-	4	-	3	-	3	-	3	-	3
E New River	Diverted	670	100	-	770	-	8	-	8	-	7	-	7	-	5	-	5	-	5	-	5	-	4	-	4	-	4	-	4
	Net Use	436	40	-	476	-	3	-	3	-	3	-	3	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
F Burnt Ranch	Diverted	2,110	600	1,136	3,846	-	48	114	162	-	42	23	65	-	30	11	41	-	30	11	41	-	24	11	35	-	24	11	35
	Net Use	1,372	240	-	1,612	-	20	-	20	-	17	-	17	-	12	-	12	-	12	-	12	-	10	-	10	-	10	-	10
G Hayfork Valley	Diverted	17,320	1,400	-	18,720	-	112	-	112	-	98	-	98	-	70	-	70	-	70	-	70	-	56	-	56	-	56	-	56
	Net Use	11,258	560	-	11,818	-	45	-	45	-	39	-	39	-	28	-	28	-	28	-	28	-	22	-	22	-	22	-	22
H Hayfork Creek	Diverted	1,700	100	-	1,800	-	8	-	8	-	7	-	7	-	5	-	5	-	5	-	5	-	4	-	4	-	4	-	4
	Net Use	1,105	40	-	1,145	-	3	-	3	-	3	-	3	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
J Upper South Fork	Diverted	720	100	-	820	-	8	-	8	-	7	-	7	-	6	-	6	-	5	-	5	-	5	-	5	-	5	-	5
	Net Use	468	40	-	508	-	3	-	3	-	3	-	3	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
K Hyampom	Diverted	110	-	709	819	-	-	71	71	-	-	14	14	-	-	7	7	-	-	7	7	-	-	7	7	-	-	7	7
	Net Use	72	-	-	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L Lower South Fork	Diverted	1,240	100	426	1,766	-	8	43	51	-	7	9	16	-	6	4	10	-	5	4	9	-	5	4	9	-	5	4	9
	Net Use	806	40	-	846	-	3	-	3	-	3	-	3	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
M Willow Creek	Diverted	2,820	400	570	3,790	-	32	57	89	-	28	11	39	-	24	6	30	-	20	6	26	-	20	6	26	-	20	6	26
	Net Use	1,833	160	-	1,993	-	13	-	13	-	11	-	11	-	10	-	10	-	8	-	8	-	8	-	8	-	8	-	8
N Hoopa Valley	Diverted	5,310	700	1,565	7,575	-	56	156	212	-	49	31	80	-	42	16	58	-	35	16	51	-	35	16	51	-	35	16	51
	Net Use	3,452	280	-	3,732	-	22	-	22	-	20	-	20	-	17	-	17	-	14	-	14	-	14	-	14	-	14	-	14
Hydrographic Unit Totals	Diverted	38,320	6,300	14,215	58,835	-	504	1,422	1,926	-	441	284	725	-	328	142	470	-	315	142	457	-	265	142	407	-	265	142	407
	Net Use	24,911	2,520	-	27,431	-	201	-	201	-	178	-	178	-	131	-	131	-	126	-	126	-	106	-	106	-	106	-	106

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

TRINITY RIVER HYDROGRAPHIC UNIT (2020) (Continued)

Subunit		April				May				June				July				August				September			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
A Trinity Reservoir	Diverted	-	35	65	100	161	42	65	268	376	70	1,308	1,754	483	105	1,439	2,027	430	119	1,439	1,988	340	98	1,177	1,555
	Net Use	-	14	-	14	105	17	-	122	244	28	-	272	314	42	-	356	280	48	-	328	221	39	-	260
B Weaver Creek	Diverted	-	75	6	81	84	90	6	180	195	150	114	459	251	225	125	601	223	255	125	603	177	210	102	489
	Net Use	-	30	-	30	55	36	-	91	127	60	-	187	163	90	-	253	145	102	-	247	115	84	-	199
C Middle Trinity	Diverted	-	20	11	31	314	24	11	349	733	40	228	1,001	942	60	250	1,252	838	68	250	1,156	663	56	205	924
	Net Use	-	8	-	8	204	10	-	214	476	16	-	492	612	24	-	636	545	28	-	573	431	22	-	453
D Helena	Diverted	-	10	16	26	10	12	16	38	23	20	313	356	30	30	344	404	26	34	344	404	21	28	281	330
	Net Use	-	4	-	4	7	5	-	12	15	8	-	23	20	12	-	32	17	14	-	31	13	11	-	24
E New River	Diverted	-	5	-	5	60	6	-	66	141	10	-	151	181	15	-	196	161	17	-	178	127	14	-	141
	Net Use	-	2	-	2	39	2	-	41	92	4	-	96	118	6	-	124	105	6	-	111	82	6	-	88
F Burnt Ranch	Diverted	-	30	11	41	190	36	11	237	443	60	228	731	570	90	250	910	506	102	250	858	401	84	205	690
	Net Use	-	12	-	12	124	14	-	138	288	24	-	312	371	35	-	406	329	40	-	369	260	34	-	294
G Hayfork Valley	Diverted	-	70	-	70	1,559	84	-	1,643	3,637	140	-	3,777	4,676	210	-	4,886	4,157	238	-	4,395	3,291	196	-	3,487
	Net Use	-	28	-	28	1,013	34	-	1,047	2,364	56	-	2,420	3,039	85	-	3,124	2,702	95	-	2,797	2,140	78	-	2,218
H Hayfork Creek	Diverted	-	5	-	5	153	6	-	159	357	10	-	367	459	15	-	474	408	17	-	425	323	14	-	337
	Net Use	-	2	-	2	99	2	-	101	232	4	-	236	298	6	-	304	266	6	-	272	210	6	-	216
J Upper South Fork	Diverted	-	6	-	6	65	10	-	75	151	13	-	164	194	14	-	208	173	12	-	185	137	9	-	146
	Net Use	-	2	-	2	42	4	-	46	98	5	-	103	126	6	-	132	113	5	-	118	89	4	-	93
K Hyampom	Diverted	-	-	7	7	10	-	7	17	23	-	142	165	30	-	156	186	26	-	156	182	21	-	128	149
	Net Use	-	-	-	-	7	-	-	7	15	-	-	15	20	-	-	20	17	-	-	17	13	-	-	13
L Lower South Fork	Diverted	-	6	4	10	112	10	4	126	260	13	85	358	335	14	94	443	298	12	94	404	235	9	77	321
	Net Use	-	2	-	2	73	4	-	77	169	5	-	174	218	6	-	224	194	5	-	199	152	4	-	156
M Willow Creek	Diverted	-	24	6	30	254	40	6	300	592	52	114	758	761	56	125	942	677	48	125	850	536	36	102	674
	Net Use	-	10	-	10	165	16	-	181	385	21	-	406	495	22	-	517	440	19	-	459	348	14	-	362
N Hoopa Valley	Diverted	-	42	16	58	478	70	16	564	1,115	91	313	1,519	1,434	98	344	1,876	1,274	84	344	1,702	1,009	63	281	1,353
	Net Use	-	17	-	17	311	28	-	339	725	36	-	761	932	39	-	971	828	34	-	862	656	25	-	681
Hydrographic Unit Totals	Diverted	-	328	142	470	3,450	430	142	4,022	8,046	669	2,845	11,560	10,346	932	3,127	14,405	9,197	1,006	3,127	13,330	7,281	817	2,558	10,656
	Net Use	-	131	-	131	2,244	172	-	2,416	5,230	267	-	5,497	6,726	373	-	7,099	5,981	402	-	6,383	4,730	327	-	5,057

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT (1990)

Subunit		Annual: Farm Irrigation	Annual: Municipal and Industrial	Annual: Recreational	Annual: Total	October: Farm Irrigation	October: Municipal and Industrial	October: Recreational	October: Total	November: Farm Irrigation	November: Municipal and Industrial	November: Recreational	November: Total
A Ruth	Diverted	130	-	27	157	-	-	2	2	-	-	1	1
	Net Use	85	-	-	85	-	-	-	-	-	-	-	-
B Butler Valley	Diverted	790	100	12	902	-	8	1	9	-	7	1	8
	Net Use	514	40	-	554	-	3	-	3	-	3	-	3
C North Fork	Diverted	50	200	-	250	-	16	-	16	-	14	-	14
	Net Use	33	80	-	113	-	6	-	6	-	6	-	6
D Blue Lake	Diverted	13,830	24,000	12	37,842	-	1,920	1	1,921	-	1,920	1	1,921
	Net Use	13,830	24,000	12	37,842	-	1,920	1	1,921	-	1,920	1	1,921
E Snow Camp	Diverted	80	-	-	80	-	-	-	-	-	-	-	-
	Net Use	52	-	-	52	-	-	-	-	-	-	-	-
F Beaver	Diverted	110	-	-	110	-	-	-	-	-	-	-	-
	Net Use	72	-	-	72	-	-	-	-	-	-	-	-
G Orick	Diverted	1,680	200	73	1,953	-	16	7	23	-	14	1	15
	Net Use	1,680	200	73	1,953	-	16	7	23	-	14	1	15
H Big Lagoon	Diverted	1,260	700	73	2,033	-	56	7	63	-	49	1	50
	Net Use	1,260	700	73	2,033	-	56	7	63	-	49	1	50
J Little River	Diverted	760	500	27	1,287	-	40	2	42	-	35	1	36
	Net Use	760	500	27	1,287	-	40	2	42	-	35	1	36
Hydrographic Unit Totals	Diverted	18,690	25,700	224	44,614	-	2,056	20	2,076	-	2,039	6	2,045
	Net Use	18,286	25,520	185	43,991	-	2,041	17	2,058	-	2,027	4	2,031

Subunit		December: Farm Irrigation	December: Municipal and Industrial	December: Recreational	December: Total	January: Farm Irrigation	January: Municipal and Industrial	January: Recreational	January: Total	February: Farm Irrigation	February: Municipal and Industrial	February: Recreational	February: Total	March: Farm Irrigation	March: Municipal and Industrial	March: Recreational	March: Total
A Ruth	Diverted	-	-	1	1	-	-	1	1	-	-	1	1	-	-	1	1
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B Butler Valley	Diverted	-	7	1	8	-	7	1	8	-	7	1	8	-	7	1	8
	Net Use	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3
C North Fork	Diverted	-	14	-	14	-	14	-	14	-	14	-	14	-	14	-	14
	Net Use	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6
D Blue Lake	Diverted	-	1,920	1	1,921	-	1,920	1	1,921	-	1,920	1	1,921	-	1,920	1	1,921
	Net Use	-	1,920	1	1,921	-	1,920	1	1,921	-	1,920	1	1,921	-	1,920	1	1,921
E Snow Camp	Diverted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F Beaver	Diverted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G Orick	Diverted	-	14	1	15	-	14	1	15	-	14	1	15	-	14	1	15
	Net Use	-	14	1	15	-	14	1	15	-	14	1	15	-	14	1	15
H Big Lagoon	Diverted	-	49	1	50	-	49	1	50	-	49	1	50	-	49	1	50
	Net Use	-	49	1	50	-	49	1	50	-	49	1	50	-	49	1	50
J Little River	Diverted	-	35	1	36	-	35	1	36	-	35	1	36	-	35	1	36
	Net Use	-	35	1	36	-	35	1	36	-	35	1	36	-	35	1	36
Hydrographic Unit Totals	Diverted	-	2,039	6	2,045	-	2,039	6	2,045	-	2,039	6	2,045	-	2,039	6	2,045
	Net Use	-	2,027	4	2,031	-	2,027	4	2,031	-	2,027	4	2,031	-	2,027	4	2,031

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		April				May				June				July				August				September			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT (1990) (Continued)																									
A Ruth	Diverted	-	-	1	1	12	-	1	13	27	-	4	31	35	-	5	40	31	-	5	36	25	-	4	29
	Net Use	-	-	-	-	8	-	-	8	18	-	-	18	23	-	-	23	20	-	-	20	16	-	-	16
B Butler Valley	Diverted	-	7	1	8	71	8	1	80	166	10	1	177	213	12	1	226	190	11	1	202	150	9	1	160
	Net Use	-	3	-	3	46	3	-	49	108	4	-	112	138	4	-	142	124	4	-	128	98	4	-	102
C North Fork	Diverted	-	14	-	14	5	16	-	21	10	20	-	30	14	24	-	38	12	22	-	34	9	18	-	27
	Net Use	-	6	-	6	3	6	-	9	7	8	-	15	9	9	-	18	8	8	-	16	6	7	-	13
D Blue Lake	Diverted	-	1,920	1	1,921	830	1,920	1	2,751	2,213	2,160	1	4,374	4,840	2,160	1	7,001	4,564	2,160	1	6,725	1,383	2,160	1	3,544
	Net Use	-	1,920	1	1,921	830	1,920	1	2,751	2,213	2,160	1	4,374	4,840	2,160	1	7,001	4,564	2,160	1	6,725	1,383	2,160	1	3,544
E Snow Camp	Diverted	-	-	-	-	7	-	-	7	17	-	-	17	22	-	-	22	19	-	-	19	15	-	-	15
	Net Use	-	-	-	-	5	-	-	5	11	-	-	11	14	-	-	14	12	-	-	12	10	-	-	10
F Beaver	Diverted	-	-	-	-	10	-	-	10	23	-	-	23	30	-	-	30	26	-	-	26	21	-	-	21
	Net Use	-	-	-	-	7	-	-	7	15	-	-	15	19	-	-	19	17	-	-	17	14	-	-	14
G Orick	Diverted	-	14	1	15	101	16	1	118	269	20	14	303	588	24	16	628	554	22	16	592	168	18	13	199
	Net Use	-	14	1	15	101	16	1	118	269	20	14	303	588	24	16	628	554	22	16	592	168	18	13	199
H Big Lagoon	Diverted	-	49	1	50	76	56	1	133	202	70	14	286	440	84	16	540	416	77	16	509	126	63	13	202
	Net Use	-	49	1	50	76	56	1	133	202	70	14	286	440	84	16	540	416	77	16	509	126	63	13	202
J Little River	Diverted	-	35	1	36	46	40	1	87	122	50	4	176	266	60	5	331	250	55	5	310	76	45	4	125
	Net Use	-	35	1	36	46	40	1	87	122	50	4	176	266	60	5	331	250	55	5	310	76	45	4	125
Hydrographic Unit Totals	Diverted	-	2,039	6	2,045	1,158	2,056	6	3,220	3,049	2,330	38	5,417	6,448	2,364	44	8,856	6,062	2,347	44	8,453	1,973	2,313	36	4,322
	Net Use	-	2,027	4	2,031	1,122	2,041	4	3,167	2,965	2,312	33	5,310	6,337	2,341	38	8,716	5,965	2,326	38	8,329	1,897	2,297	31	4,225

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE
AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		Annual				October				November				December				January				February				March			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT (2020)																													
A Ruth	Diverted	330	100	88	518	-	8	9	17	-	7	2	9	-	7	1	8	-	7	1	8	-	7	1	8	-	7	1	8
	Net Use	215	40	-	255	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3
B Butler Valley	Diverted	1,320	200	33	1,553	-	16	3	19	-	14	1	15	-	14	1	15	-	14	1	15	-	14	1	15	-	14	1	15
	Net Use	858	80	-	938	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6
C North Fork	Diverted	50	400	-	450	-	32	-	32	-	28	-	28	-	28	-	28	-	28	-	28	-	28	-	28	-	28	-	28
	Net Use	33	160	-	193	-	13	-	13	-	11	-	11	-	11	-	11	-	11	-	11	-	11	-	11	-	11	-	11
D Blue Lake	Diverted	9,560	48,000	33	57,593	-	3,840	3	3,843	-	3,840	1	3,841	-	3,840	1	3,841	-	3,840	1	3,841	-	3,840	1	3,841	-	3,840	1	3,841
	Net Use	9,560	48,000	33	57,593	-	3,840	3	3,843	-	3,840	1	3,841	-	3,840	1	3,841	-	3,840	1	3,841	-	3,840	1	3,841	-	3,840	1	3,841
E Snow Camp	Diverted	200	-	12	212	-	-	1	1	-	-	1	1	-	-	1	1	-	-	1	1	-	-	1	1	-	-	1	1
	Net Use	130	-	-	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F Beaver	Diverted	140	100	12	252	-	8	1	9	-	7	1	8	-	7	1	8	-	7	1	8	-	7	1	8	-	7	1	8
	Net Use	91	40	-	131	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3
G Orick	Diverted	1,340	600	279	2,219	-	48	28	76	-	42	6	48	-	42	3	45	-	42	3	45	-	42	3	45	-	42	3	45
	Net Use	1,340	600	279	2,219	-	48	28	76	-	42	6	48	-	42	3	45	-	42	3	45	-	42	3	45	-	42	3	45
H Big Lagoon	Diverted	2,360	1,700	279	4,339	-	136	28	164	-	119	6	125	-	119	3	122	-	119	3	122	-	119	3	122	-	119	3	122
	Net Use	2,360	1,700	279	4,339	-	136	28	164	-	119	6	125	-	119	3	122	-	119	3	122	-	119	3	122	-	119	3	122
J Little River	Diverted	550	1,300	88	1,938	-	104	9	113	-	91	2	93	-	91	1	92	-	91	1	92	-	91	1	92	-	91	1	92
	Net Use	550	1,300	88	1,938	-	104	9	113	-	91	2	93	-	91	1	92	-	91	1	92	-	91	1	92	-	91	1	92
Hydrographic Unit Totals	Diverted	15,850	52,400	824	69,074	-	4,192	82	4,274	-	4,148	20	4,168	-	4,148	12	4,160	-	4,148	12	4,160	-	4,148	12	4,160	-	4,148	12	4,160
	Net Use	15,137	51,920	679	67,736	-	4,153	68	4,221	-	4,115	15	4,130	-	4,115	8	4,123	-	4,115	8	4,123	-	4,115	8	4,123	-	4,115	8	4,123

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT (2020) (Continued)

Subunit		April Farm irrigation	April Municipal and industrial	April Recreational	April Total	May Farm irrigation	May Municipal and industrial	May Recreational	May Total
A Ruth	Diverted	-	7	1	8	30	8	1	39
	Net Use	-	3	-	3	20	3	-	23
B Butler Valley	Diverted	-	14	1	15	119	16	1	136
	Net Use	-	6	-	6	78	6	-	84
C North Fork	Diverted	-	28	-	28	5	32	-	37
	Net Use	-	11	-	11	3	13	-	16
D Blue Lake	Diverted	-	3,840	1	3,841	574	3,840	1	4,415
	Net Use	-	3,840	1	3,841	574	3,840	1	4,415
E Snow Camp	Diverted	-	-	1	1	18	-	1	19
	Net Use	-	-	-	-	12	-	-	12
F Beaver	Diverted	-	7	1	8	13	8	1	22
	Net Use	-	3	-	3	8	3	-	11
G Orick	Diverted	-	42	3	45	80	48	3	131
	Net Use	-	42	3	45	80	48	3	131
H Big Lagoon	Diverted	-	119	3	122	142	136	3	281
	Net Use	-	119	3	122	142	136	3	281
J Little River	Diverted	-	91	1	92	33	104	1	138
	Net Use	-	91	1	92	33	104	1	138
Hydrographic Unit Totals	Diverted	-	4,148	12	4,160	1,014	4,192	12	5,218
	Net Use	-	4,115	8	4,123	950	4,153	8	5,111

Subunit		June Farm irrigation	June Municipal and industrial	June Recreational	June Total	July Farm irrigation	July Municipal and industrial	July Recreational	July Total
A Ruth	Diverted	69	10	17	96	89	12	19	120
	Net Use	45	4	-	49	58	4	-	62
B Butler Valley	Diverted	277	20	6	303	356	24	6	386
	Net Use	180	8	-	188	231	9	-	240
C North Fork	Diverted	10	40	-	50	14	48	-	62
	Net Use	7	16	-	23	9	19	-	28
D Blue Lake	Diverted	1,530	4,320	6	5,856	3,345	4,320	6	7,671
	Net Use	1,530	4,320	6	5,856	3,345	4,320	6	7,671
E Snow Camp	Diverted	42	-	1	43	54	-	1	55
	Net Use	27	-	-	27	35	-	-	35
F Beaver	Diverted	29	10	1	40	38	12	1	51
	Net Use	19	4	-	23	25	4	-	29
G Orick	Diverted	214	60	55	329	470	72	61	603
	Net Use	214	60	55	329	470	72	61	603
H Big Lagoon	Diverted	378	170	55	603	825	204	61	1,090
	Net Use	378	170	55	603	825	204	61	1,090
J Little River	Diverted	88	130	17	235	192	156	19	367
	Net Use	88	130	17	235	192	156	19	367
Hydrographic Unit Totals	Diverted	2,637	4,760	158	7,555	5,383	4,848	174	10,405
	Net Use	2,488	4,712	133	7,333	5,190	4,788	147	10,125

Subunit		August Farm irrigation	August Municipal and industrial	August Recreational	August Total	September Farm irrigation	September Municipal and industrial	September Recreational	September Total
A Ruth	Diverted	79	11	19	109	63	9	16	88
	Net Use	51	4	-	55	41	4	-	45
B Butler Valley	Diverted	317	22	6	345	251	18	5	274
	Net Use	206	8	-	214	163	7	-	170
C North Fork	Diverted	12	44	-	56	9	36	-	45
	Net Use	8	18	-	26	6	15	-	21
D Blue Lake	Diverted	3,155	4,320	6	7,481	956	4,320	5	5,281
	Net Use	3,155	4,320	6	7,481	956	4,320	5	5,281
E Snow Camp	Diverted	48	-	1	49	38	-	1	39
	Net Use	31	-	-	31	25	-	-	25
F Beaver	Diverted	34	11	1	46	26	9	1	36
	Net Use	22	4	-	26	17	4	-	21
G Orick	Diverted	442	66	61	569	134	54	50	238
	Net Use	442	66	61	569	134	54	50	238
H Big Lagoon	Diverted	779	187	61	1,027	236	153	50	439
	Net Use	779	187	61	1,027	236	153	50	439
J Little River	Diverted	182	143	19	344	55	117	16	188
	Net Use	182	143	19	344	55	117	16	188
Hydrographic Unit Totals	Diverted	5,048	4,804	174	10,026	1,768	4,716	144	6,628
	Net Use	4,876	4,750	147	9,773	1,633	4,674	121	6,428

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		Annual				October				November				December				January				February				March			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
EEL RIVER HYDROGRAPHIC UNIT (1990)																													
A Lake Pillsbury	Diverted	480	-	313	793	-	-	31	31	-	-	6	6	-	-	3	3	-	-	3	3	-	-	3	3	-	-	3	3
	Net Use	312	-	-	312	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B Outlet Creek	Diverted	7,430	2,400	36	9,866	-	192	3	195	-	168	1	169	-	144	1	145	-	144	1	145	-	144	1	145	-	144	1	145
	Net Use	4,830	960	-	5,790	-	77	-	77	-	67	-	67	-	58	-	58	-	58	-	58	-	58	-	58	-	58	-	58
C Willis Ridge	Diverted	1,300	-	438	1,738	-	-	44	44	-	-	9	9	-	-	4	4	-	-	4	4	-	-	4	4	-	-	4	4
	Net Use	845	-	-	845	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D Round Valley	Diverted	12,060	600	95	12,755	-	48	9	57	-	42	2	44	-	36	1	37	-	36	1	37	-	36	1	37	-	36	1	37
	Net Use	7,839	240	-	8,079	-	19	-	19	-	17	-	17	-	14	-	14	-	14	-	14	-	14	-	14	-	14	-	14
E Wilderness	Diverted	-	-	160	160	-	-	16	16	-	-	3	3	-	-	2	2	-	-	2	2	-	-	2	2	-	-	2	2
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F Black Butte	Diverted	20	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	13	-	-	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G Etsel	Diverted	1,050	-	313	1,363	-	-	31	31	-	-	6	6	-	-	3	3	-	-	3	3	-	-	3	3	-	-	3	3
	Net Use	683	-	-	683	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H North Fork	Diverted	430	-	-	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	280	-	-	280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J Bell Springs	Diverted	410	-	313	723	-	-	31	31	-	-	6	6	-	-	3	3	-	-	3	3	-	-	3	3	-	-	3	3
	Net Use	267	-	-	267	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K Sequoia	Diverted	930	-	438	1,368	-	-	44	44	-	-	9	9	-	-	4	4	-	-	4	4	-	-	4	4	-	-	4	4
	Net Use	605	-	-	605	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L Yager Creek	Diverted	150	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	98	-	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M Van Duzen River	Diverted	6,490	600	438	7,528	-	48	44	92	-	42	9	51	-	42	4	46	-	42	4	46	-	42	4	46	-	42	4	46
	Net Use	4,219	240	-	4,459	-	19	-	19	-	17	-	17	-	17	-	17	-	17	-	17	-	17	-	17	-	17	-	17
N Larabee Creek	Diverted	200	-	160	360	-	-	16	16	-	-	3	3	-	-	2	2	-	-	2	2	-	-	2	2	-	-	2	2
	Net Use	130	-	-	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P Laytonville	Diverted	3,450	100	-	3,550	-	8	-	8	-	7	-	7	-	6	-	6	-	6	-	6	-	6	-	6	-	6	-	6
	Net Use	2,243	40	-	2,283	-	3	-	3	-	3	-	3	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
Q Lake Benbow	Diverted	1,980	1,300	1,196	4,476	-	104	120	224	-	91	24	115	-	91	12	103	-	91	12	103	-	91	12	103	-	91	12	103
	Net Use	1,287	520	-	1,807	-	42	-	42	-	36	-	36	-	36	-	36	-	36	-	36	-	36	-	36	-	36	-	36
R Humboldt Redwoods	Diverted	660	700	1,509	2,869	-	56	151	207	-	49	30	79	-	49	15	64	-	49	15	64	-	49	15	64	-	49	15	64
	Net Use	429	280	-	709	-	22	-	22	-	20	-	20	-	20	-	20	-	20	-	20	-	20	-	20	-	20	-	20
S Lower Eel	Diverted	37,090	24,900	438	62,428	-	2,241	44	2,285	-	1,743	9	1,752	-	1,992	4	1,996	-	1,992	4	1,996	-	1,743	4	1,747	-	1,992	4	1,996
	Net Use	37,090	24,900	438	62,428	-	2,241	44	2,285	-	1,743	9	1,752	-	1,992	4	1,996	-	1,992	4	1,996	-	1,743	4	1,747	-	1,992	4	1,996
T Eureka Plain	Diverted	8,010	74,200	126	82,336	-	6,678	13	6,691	-	5,194	3	5,197	-	5,936	1	5,937	-	5,936	1	5,937	-	5,194	1	5,195	-	5,936	1	5,937
	Net Use	8,010	74,200	126	82,336	-	6,678	13	6,691	-	5,194	3	5,197	-	5,936	1	5,937	-	5,936	1	5,937	-	5,194	1	5,195	-	5,936	1	5,937
U Cape Mendocino	Diverted	4,260	-	313	4,573	-	-	31	31	-	-	6	6	-	-	3	3	-	-	3	3	-	-	3	3	-	-	3	3
	Net Use	4,260	-	313	4,573	-	-	31	31	-	-	6	6	-	-	3	3	-	-	3	3	-	-	3	3	-	-	3	3
Hydrographic Unit Totals	Diverted	86,400	104,800	6,286	197,486	-	9,375	628	10,003	-	7,336	126	7,462	-	8,296	62	8,358	-	8,296	62	8,358	-	7,305	62	7,367	-	8,296	62	8,358
	Net Use	73,440	101,380	877	175,697	-	9,101	88	9,189	-	7,097	18	7,115	-	8,075	8	8,083	-	8,075	8	8,083	-	7,084	8	7,092	-	8,075	8	8,083

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		April				May				June				July				August				September			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
EEL RIVER HYDROGRAPHIC UNIT (1990) (Continued)																									
A Lake Pillsbury	Diverted	-	-	3	3	43	-	3	46	101	-	63	164	130	-	69	199	115	-	69	184	91	-	57	148
	Net Use	-	-	-	-	28	-	-	28	66	-	-	66	84	-	-	84	75	-	-	75	59	-	-	59
B Outlet Creek	Diverted	-	168	1	169	595	192	1	788	1,783	216	6	2,005	2,080	312	7	2,399	1,635	312	7	1,954	1,337	264	6	1,607
	Net Use	-	67	-	67	387	77	-	464	1,159	86	-	1,245	1,352	124	-	1,476	1,063	124	-	1,187	869	106	-	975
C Willie Ridge	Diverted	-	-	4	4	117	-	4	121	273	-	88	361	351	-	97	448	312	-	97	409	247	-	79	326
	Net Use	-	-	-	-	76	-	-	76	177	-	-	177	228	-	-	228	203	-	-	203	161	-	-	161
D Round Valley	Diverted	-	42	1	43	965	48	1	1,014	2,894	54	19	2,967	3,377	78	21	3,476	2,653	78	21	2,752	2,171	66	17	2,254
	Net Use	-	17	-	17	627	19	-	646	1,881	22	-	1,903	2,196	32	-	2,228	1,724	32	-	1,756	1,411	26	-	1,437
E Wilderness	Diverted	-	-	2	2	-	-	2	2	-	-	31	31	-	-	35	35	-	-	35	35	-	-	28	28
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F Black Butte	Diverted	-	-	-	-	2	-	-	2	4	-	-	4	5	-	-	5	5	-	-	5	4	-	-	4
	Net Use	-	-	-	-	1	-	-	1	3	-	-	3	3	-	-	3	3	-	-	3	3	-	-	3
G Etsel	Diverted	-	-	3	3	95	-	3	98	221	-	63	284	282	-	69	351	252	-	69	321	200	-	57	257
	Net Use	-	-	-	-	62	-	-	62	144	-	-	144	183	-	-	183	164	-	-	164	130	-	-	130
H North Fork	Diverted	-	-	-	-	39	-	-	39	90	-	-	90	116	-	-	116	103	-	-	103	82	-	-	82
	Net Use	-	-	-	-	25	-	-	25	59	-	-	59	76	-	-	76	67	-	-	67	53	-	-	53
J Bell Springs	Diverted	-	-	3	3	37	-	3	40	86	-	63	149	111	-	69	180	98	-	69	167	78	-	57	135
	Net Use	-	-	-	-	24	-	-	24	56	-	-	56	72	-	-	72	64	-	-	64	51	-	-	51
K Sequoia	Diverted	-	-	4	4	84	-	4	88	195	-	88	283	251	-	97	348	223	-	97	320	177	-	79	256
	Net Use	-	-	-	-	55	-	-	55	127	-	-	127	163	-	-	163	145	-	-	145	115	-	-	115
L Yager Creek	Diverted	-	-	-	-	14	-	-	14	32	-	-	32	39	-	-	39	36	-	-	36	29	-	-	29
	Net Use	-	-	-	-	9	-	-	9	21	-	-	21	26	-	-	26	23	-	-	23	19	-	-	19
M Van Duzen River	Diverted	-	42	4	46	389	48	4	441	1,038	60	88	1,186	2,272	72	97	2,441	2,142	66	97	2,305	649	54	79	782
	Net Use	-	17	-	17	253	19	-	272	675	23	-	698	1,477	29	-	1,506	1,392	26	-	1,418	422	22	-	444
N Larabee Creek	Diverted	-	-	2	2	18	-	2	20	42	-	31	73	54	-	35	89	48	-	35	83	38	-	28	66
	Net Use	-	-	-	-	12	-	-	12	27	-	-	27	35	-	-	35	31	-	-	31	25	-	-	25
P Laytonville	Diverted	-	7	-	7	276	8	-	284	828	9	-	837	966	13	-	979	759	13	-	772	621	11	-	632
	Net Use	-	3	-	3	179	3	-	182	538	4	-	542	629	6	-	635	493	6	-	499	404	4	-	408
Q Lake Benbow	Diverted	-	91	12	103	178	104	12	294	416	130	239	785	535	156	263	954	475	143	263	881	376	117	215	708
	Net Use	-	36	-	36	116	42	-	58	270	52	-	322	348	63	-	411	309	58	-	367	244	47	-	291
R Humboldt Redwoods	Diverted	-	49	15	64	40	56	15	111	106	70	302	478	230	84	332	646	218	77	332	627	66	63	272	401
	Net Use	-	20	-	20	26	22	-	48	69	28	-	97	150	33	-	183	141	30	-	171	43	25	-	68
S Lower Eel	Diverted	-	1,992	4	1,996	2,226	2,241	4	4,471	5,934	2,241	88	8,263	12,981	2,241	97	15,319	12,240	2,241	97	14,578	3,709	2,241	79	6,029
	Net Use	-	1,996	4	1,996	2,226	2,241	4	4,471	5,934	2,241	88	8,263	12,981	2,241	97	15,319	12,240	2,241	97	14,578	3,709	2,241	79	6,029
T Eureka Plain	Diverted	-	5,936	1	5,937	481	6,678	1	7,160	1,282	6,678	25	7,985	2,803	6,678	28	9,509	2,643	6,678	28	9,349	801	6,678	23	7,502
	Net Use	-	5,936	1	5,937	481	6,678	1	7,160	1,282	6,678	25	7,985	2,803	6,678	28	9,509	2,643	6,678	28	9,349	801	6,678	23	7,502
U Cape Mendocino	Diverted	-	-	3	3	341	-	3	344	1,022	-	63	1,085	1,193	-	69	1,262	937	-	69	1,006	767	-	57	824
	Net Use	-	-	3	3	341	-	3	344	1,022	-	63	1,085	1,193	-	69	1,262	937	-	69	1,006	767	-	57	824
Hydrographic Unit Totals	Diverted	-	8,327	62	8,389	5,940	9,375	62	15,377	16,347	9,458	1,257	27,062	27,776	9,634	1,385	38,795	24,894	9,608	1,385	35,887	11,443	9,494	1,133	22,070
	Net Use	-	8,088	8	8,096	4,928	9,101	8	14,037	13,510	9,134	176	22,820	23,999	9,206	194	33,399	21,717	9,195	194	31,106	9,286	9,149	159	18,594

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

EEL RIVER HYDROGRAPHIC UNIT (2020)

Subunit		Annual				October				November				December				January				February				March			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
A Lake Pillsbury	Diverted	930	-	1,195	2,125	-	-	119	119	-	-	24	24	-	-	12	12	-	-	12	12	-	-	12	12	-	-	12	12
	Net Use	605	-	-	605	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B Outlet Creek	Diverted	14,810	5,000	118	19,928	-	400	12	412	-	350	3	353	-	300	1	301	-	300	1	301	-	300	1	301	-	300	1	301
	Net Use	9,627	2,000	-	11,627	-	160	-	160	-	140	-	140	-	120	-	120	-	120	-	120	-	120	-	120	-	120	-	120
C Willis Ridge	Diverted	2,430	-	1,673	4,103	-	-	167	167	-	-	33	33	-	-	17	17	-	-	17	17	-	-	17	17	-	-	17	17
	Net Use	1,580	-	-	1,580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D Round Valley	Diverted	29,620	2,000	361	31,981	-	160	36	196	-	140	7	147	-	120	4	124	-	120	4	124	-	120	4	124	-	120	4	124
	Net Use	19,253	800	-	20,053	-	64	-	64	-	56	-	56	-	48	-	48	-	48	-	48	-	48	-	48	-	48	-	48
E Wilderness	Diverted	-	-	596	596	-	-	60	60	-	-	12	12	-	-	6	6	-	-	6	6	-	-	6	6	-	-	6	6
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F Black Butts	Diverted	80	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	52	-	-	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G Etsel	Diverted	2,430	-	1,195	3,625	-	-	119	119	-	-	24	24	-	-	12	12	-	-	12	12	-	-	12	12	-	-	12	12
	Net Use	1,580	-	-	1,580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H North Fork	Diverted	750	-	-	750	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	488	-	-	488	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J Bell Springs	Diverted	660	-	1,195	1,855	-	-	119	119	-	-	24	24	-	-	12	12	-	-	12	12	-	-	12	12	-	-	12	12
	Net Use	429	-	-	429	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K Sequoia	Diverted	1,410	-	1,673	3,083	-	-	167	167	-	-	33	33	-	-	17	17	-	-	17	17	-	-	17	17	-	-	17	17
	Net Use	917	-	-	917	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L Yager Creek	Diverted	350	-	-	350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Net Use	228	-	-	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M Van Duzen River	Diverted	8,340	1,500	1,673	11,513	-	120	167	287	-	105	33	138	-	105	17	122	-	105	17	122	-	105	17	122	-	105	17	122
	Net Use	5,421	600	-	6,021	-	48	-	48	-	42	-	42	-	42	-	42	-	42	-	42	-	42	-	42	-	42	-	42
N Larabee Creek	Diverted	250	-	596	846	-	-	60	60	-	-	12	12	-	-	6	6	-	-	6	6	-	-	6	6	-	-	6	6
	Net Use	162	-	-	162	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P Laytonville	Diverted	7,540	200	-	7,740	-	16	-	16	-	14	-	14	-	12	-	12	-	12	-	12	-	12	-	12	-	12	-	12
	Net Use	4,901	80	-	4,981	-	6	-	6	-	6	-	6	-	5	-	5	-	5	-	5	-	5	-	5	-	5	-	5
Q Lake Benbow	Diverted	-	2,900	4,536	7,436	-	232	454	686	-	203	91	294	-	203	45	248	-	203	45	248	-	203	45	248	-	203	45	248
	Net Use	-	1,160	-	1,160	-	93	-	93	-	81	-	81	-	81	-	81	-	81	-	81	-	81	-	81	-	81	-	81
R Humboldt Redwoods	Diverted	-	1,200	5,730	6,930	-	96	573	669	-	84	115	199	-	84	57	141	-	84	57	141	-	84	57	141	-	84	57	141
	Net Use	-	480	-	480	-	38	-	38	-	34	-	34	-	34	-	34	-	34	-	34	-	34	-	34	-	34	-	34
S Lower Eel	Diverted	35,860	50,100	1,673	87,633	-	4,509	167	4,676	-	3,507	33	3,540	-	4,008	17	4,025	-	4,008	17	4,025	-	3,507	17	3,524	-	4,008	17	4,025
	Net Use	35,860	50,100	1,673	87,633	-	4,509	167	4,676	-	3,507	33	3,540	-	4,008	17	4,025	-	4,008	17	4,025	-	3,507	17	3,524	-	4,008	17	4,025
T Eureka Plain	Diverted	5,310	118,500	480	124,290	-	10,665	48	10,713	-	8,295	10	8,305	-	9,480	5	9,485	-	9,480	5	9,485	-	8,295	5	8,300	-	9,480	5	9,485
	Net Use	5,310	118,500	480	124,290	-	10,665	48	10,713	-	8,295	10	8,305	-	9,480	5	9,485	-	9,480	5	9,485	-	8,295	5	8,300	-	9,480	5	9,485
U Cape Mendocino	Diverted	6,860	-	1,195	8,055	-	-	119	119	-	-	24	24	-	-	12	12	-	-	12	12	-	-	12	12	-	-	12	12
	Net Use	6,860	-	1,195	8,055	-	-	119	119	-	-	24	24	-	-	12	12	-	-	12	12	-	-	12	12	-	-	12	12
Hydrographic Unit Totals	Diverted	117,630	181,400	23,889	322,919	-	16,198	2,387	18,585	-	12,698	478	13,176	-	14,312	240	14,552	-	14,312	240	14,552	-	12,626	240	12,866	-	14,312	240	14,552
	Net Use	93,273	173,720	3,348	270,341	-	15,583	334	15,917	-	12,161	67	12,228	-	13,818	34	13,852	-	13,818	34	13,852	-	12,132	34	12,166	-	13,819	34	13,852

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPAL AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		April Farm irrigation	April Municipal and industrial	April Recreational	April Total	May Farm irrigation	May Municipal and industrial	May Recreational	May Total	June Farm irrigation	June Municipal and industrial	June Recreational	June Total	July Farm irrigation	July Municipal and industrial	July Recreational	July Total	August Farm irrigation	August Municipal and industrial	August Recreational	August Total	September Farm irrigation	September Municipal and industrial	September Recreational	September Total
EEL RIVER HYDROGRAPHIC UNIT (2020) (Continued)																									
A Lake Pillsbury	Diverted	-	-	12	12	84	-	12	96	195	-	239	434	251	-	263	514	223	-	263	486	177	-	215	392
	Net Use	-	-	-	-	55	-	-	55	127	-	-	127	163	-	-	163	145	-	-	145	115	-	-	115
B Outlet Creek	Diverted	-	350	1	351	1,185	400	1	1,586	3,554	450	24	4,028	4,147	650	26	4,823	3,258	650	26	3,934	2,666	550	21	3,237
	Net Use	-	140	-	140	770	160	-	930	2,310	180	-	2,490	2,696	260	-	2,956	2,118	260	-	2,378	1,733	220	-	1,953
C Willis Ridge	Diverted	-	-	17	17	219	-	17	236	510	-	334	844	656	-	368	1,024	583	-	368	951	462	-	301	763
	Net Use	-	-	-	-	142	-	-	142	332	-	-	332	426	-	-	426	379	-	-	379	301	-	-	301
D Round Valley	Diverted	-	140	4	144	2,370	160	4	2,534	7,109	180	72	7,361	8,293	260	79	8,632	6,516	260	79	6,855	5,332	220	64	5,616
	Net Use	-	56	-	56	1,541	64	-	1,605	4,621	72	-	4,693	5,390	104	-	5,494	4,235	104	-	4,339	3,466	88	-	3,554
E Wilderness	Diverted	-	-	6	6	-	-	6	6	-	-	119	119	-	-	131	131	-	-	131	131	-	-	107	107
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F Black Butte	Diverted	-	-	-	-	7	-	-	7	17	-	-	17	22	-	-	22	19	-	-	19	15	-	-	15
	Net Use	-	-	-	-	5	-	-	5	11	-	-	11	14	-	-	14	12	-	-	12	10	-	-	10
G Etsel	Diverted	-	-	12	12	219	-	12	231	510	-	239	749	656	-	263	919	583	-	263	846	462	-	215	677
	Net Use	-	-	-	-	142	-	-	142	332	-	-	332	427	-	-	427	379	-	-	379	300	-	-	300
H North Fork	Diverted	-	-	-	-	67	-	-	67	158	-	-	158	203	-	-	203	180	-	-	180	142	-	-	142
	Net Use	-	-	-	-	44	-	-	44	103	-	-	103	132	-	-	132	117	-	-	117	92	-	-	92
J Bell Springs	Diverted	-	-	12	12	59	-	12	71	139	-	239	378	178	-	263	441	159	-	263	422	125	-	215	340
	Net Use	-	-	-	-	39	-	-	39	90	-	-	90	116	-	-	116	103	-	-	103	81	-	-	81
K Sequoia	Diverted	-	-	17	17	127	-	17	144	296	-	334	630	381	-	368	749	338	-	368	706	268	-	301	569
	Net Use	-	-	-	-	83	-	-	83	192	-	-	192	248	-	-	248	220	-	-	220	174	-	-	174
L Yager Creek	Diverted	-	-	-	-	31	-	-	31	74	-	-	74	95	-	-	95	84	-	-	84	66	-	-	66
	Net Use	-	-	-	-	20	-	-	20	48	-	-	48	62	-	-	62	55	-	-	55	43	-	-	43
M Van Duzen River	Diverted	-	105	17	122	500	120	17	637	1,334	150	334	1,818	2,920	180	368	3,468	2,752	165	368	3,285	834	135	301	1,270
	Net Use	-	42	-	42	325	48	-	373	867	60	-	927	1,898	72	-	1,970	1,789	66	-	1,855	542	54	-	596
N Larabee Creek	Diverted	-	-	6	6	22	-	6	28	52	-	119	171	68	-	131	199	60	-	131	191	48	-	107	155
	Net Use	-	-	-	-	14	-	-	14	34	-	-	34	44	-	-	44	39	-	-	39	31	-	-	31
P Laytonville	Diverted	-	14	-	14	603	16	-	619	1,810	18	-	1,828	2,111	26	-	2,137	1,659	26	-	1,685	1,357	22	-	1,379
	Net Use	-	6	-	6	392	6	-	398	1,177	7	-	1,184	1,372	10	-	1,382	1,078	10	-	1,088	882	9	-	891
Q Lake Benbow	Diverted	-	203	45	248	-	232	45	277	-	290	908	1,198	-	348	998	1,346	-	319	998	1,317	-	261	817	1,078
	Net Use	-	81	-	81	-	93	-	93	-	116	-	116	-	139	-	139	-	128	-	128	-	105	-	105
R Humboldt Redwoods	Diverted	-	84	57	141	-	96	57	153	-	120	1,146	1,266	-	144	1,261	1,405	-	132	1,261	1,393	-	108	1,032	1,140
	Net Use	-	34	-	34	-	38	-	38	-	48	-	48	-	57	-	57	-	52	-	52	-	43	-	43
S Lower Eel	Diverted	-	4,008	17	4,025	2,152	4,509	17	6,678	5,738	4,509	334	10,581	12,551	4,509	368	17,428	11,833	4,509	368	16,710	3,586	4,509	301	8,396
	Net Use	-	4,008	17	4,025	2,152	4,509	17	6,678	5,738	4,509	334	10,581	12,551	4,509	368	17,428	11,833	4,509	368	16,710	3,586	4,509	301	8,396
T Eureka Plain	Diverted	-	9,480	5	9,485	319	10,665	5	10,989	850	10,665	96	11,611	1,858	10,665	105	12,628	1,752	10,665	105	12,522	531	10,665	86	11,282
	Net Use	-	9,480	5	9,485	319	10,665	5	10,989	850	10,665	96	11,611	1,858	10,665	105	12,628	1,752	10,665	105	12,522	531	10,665	86	11,282
U Cape Mendocino	Diverted	-	-	12	12	549	-	12	561	1,646	-	239	1,885	1,921	-	263	2,184	1,509	-	263	1,772	1,235	-	215	1,450
	Net Use	-	-	12	12	549	-	12	561	1,646	-	239	1,885	1,921	-	263	2,184	1,509	-	263	1,772	1,235	-	215	1,450
Hydrographic Unit Totals	Diverted	-	14,384	240	14,624	8,513	16,198	240	24,951	23,992	16,382	4,776	45,150	36,311	16,782	5,255	58,348	31,508	16,726	5,255	53,489	17,306	16,470	4,298	38,074
	Net Use	-	13,847	34	13,881	6,502	15,583	34	22,209	18,478	15,657	669	34,804	29,318	15,816	736	45,807	25,763	15,794	736	42,293	13,122	15,693	602	29,417

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		Annual				October				November				December				January				February				March			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
MENDOCINO COAST HYDROGRAPHIC UNIT (1990)																													
A Rockport	Diverted	1,470	100	83	1,653	-	8	8	16	-	7	2	9	-	7	1	8	-	7	1	8	-	7	1	8	-	6	1	7
	Net Use	1,470	100	83	1,653	-	8	8	16	-	7	2	9	-	7	1	8	-	7	1	8	-	7	1	8	-	6	1	7
B Fort Bragg	Diverted	1,210	24,100	217	25,527	-	1,928	22	1,950	-	1,928	5	1,933	-	1,928	2	1,930	-	1,928	2	1,930	-	1,928	2	1,930	-	1,687	2	1,689
	Net Use	1,210	24,100	217	25,527	-	1,928	22	1,950	-	1,928	5	1,933	-	1,928	2	1,930	-	1,928	2	1,930	-	1,928	2	1,930	-	1,687	2	1,689
C Navarro River	Diverted	2,600	200	83	2,883	-	16	8	24	-	14	2	16	-	14	1	15	-	14	1	15	-	14	1	15	-	14	1	15
	Net Use	2,600	200	83	2,883	-	16	8	24	-	14	2	16	-	14	1	15	-	14	1	15	-	14	1	15	-	14	1	15
O Point Arena	Diverted	2,750	500	750	4,000	-	40	75	115	-	35	15	50	-	35	8	43	-	35	8	43	-	35	8	43	-	30	8	38
	Net Use	2,750	500	750	4,000	-	40	75	115	-	35	15	50	-	35	8	43	-	35	8	43	-	35	8	43	-	30	8	38
E Gualala River	Diverted	460	400	533	1,393	-	32	54	86	-	28	12	40	-	28	5	33	-	28	5	33	-	28	5	33	-	24	5	29
	Net Use	460	400	533	1,393	-	32	54	86	-	28	12	40	-	28	5	33	-	28	5	33	-	28	5	33	-	24	5	29
Hydrographic Unit Totals	Diverted	8,490	25,300	1,666	35,455	-	2,024	167	2,191	-	2,012	36	2,048	-	2,012	17	2,029	-	2,012	17	2,029	-	2,012	17	2,029	-	1,761	17	1,778
	Net Use	8,490	25,300	1,666	35,455	-	2,024	167	2,191	-	2,012	36	2,048	-	2,012	17	2,029	-	2,012	17	2,029	-	2,012	17	2,029	-	1,761	17	1,778
MENDOCINO COAST HYDROGRAPHIC UNIT (2020)																													
A Rockport	Diverted	1,810	100	214	2,124	-	8	22	30	-	7	4	11	-	7	2	9	-	7	2	9	-	7	2	9	-	6	2	8
	Net Use	1,810	100	214	2,124	-	8	22	30	-	7	4	11	-	7	2	9	-	7	2	9	-	7	2	9	-	6	2	8
B Fort Bragg	Diverted	4,450	36,000	562	41,012	-	2,880	56	2,936	-	2,880	11	2,891	-	2,880	6	2,886	-	2,880	6	2,886	-	2,880	6	2,886	-	2,520	6	2,526
	Net Use	4,450	36,000	562	41,012	-	2,880	56	2,936	-	2,880	11	2,891	-	2,880	6	2,886	-	2,880	6	2,886	-	2,880	6	2,886	-	2,520	6	2,526
C Navarro River	Diverted	8,670	300	214	9,134	-	24	22	46	-	21	4	25	-	21	2	23	-	21	2	23	-	21	2	23	-	21	2	23
	Net Use	8,670	300	214	9,134	-	24	22	46	-	21	4	25	-	21	2	23	-	21	2	23	-	21	2	23	-	21	2	23
O Point Arena	Diverted	7,310	1,200	1,935	10,445	-	96	194	290	-	84	39	123	-	84	19	103	-	84	19	103	-	84	19	103	-	72	19	91
	Net Use	7,310	1,200	1,935	10,445	-	96	194	290	-	84	39	123	-	84	19	103	-	84	19	103	-	84	19	103	-	72	19	91
E Gualala River	Diverted	940	800	1,379	3,119	-	64	138	202	-	56	28	84	-	56	14	70	-	56	14	70	-	56	14	70	-	48	14	62
	Net Use	940	800	1,379	3,119	-	64	138	202	-	56	28	84	-	56	14	70	-	56	14	70	-	56	14	70	-	48	14	62
Hydrographic Unit Totals	Diverted	23,130	38,400	4,304	65,834	-	3,072	432	3,504	-	3,048	86	3,134	-	3,048	43	3,091	-	3,048	43	3,091	-	3,043	43	3,091	-	2,667	43	2,710
	Net Use	23,130	38,400	4,304	65,834	-	3,072	432	3,504	-	3,048	86	3,134	-	3,048	43	3,091	-	3,048	43	3,091	-	3,048	43	3,091	-	2,667	43	2,710

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		April				May				June				July				August				September			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
MENDOCINO COAST HYDROGRAPHIC UNIT (1990) (Continued)																									
A Rockport	Diverted	-	8	1	9	88	9	1	98	235	11	16	262	515	11	18	544	485	10	18	513	147	9	15	171
	Net Use	-	8	1	9	88	9	1	98	235	11	16	262	515	11	18	544	485	10	18	513	147	9	15	171
B Fort Bragg	Diverted	-	1,928	2	1,930	91	2,169	2	2,262	190	2,169	43	2,402	417	2,169	48	2,634	393	2,169	48	2,610	119	2,169	39	2,327
	Net Use	-	1,928	2	1,930	91	2,169	2	2,262	190	2,169	43	2,402	417	2,169	48	2,634	393	2,169	48	2,610	119	2,169	39	2,327
C Navarro River	Diverted	-	14	1	15	208	16	1	225	624	20	16	660	728	24	18	770	572	22	18	612	468	18	15	501
	Net Use	-	14	1	15	208	16	1	225	624	20	16	660	728	24	18	770	572	22	18	612	468	18	15	501
D Point Arena	Diverted	-	40	8	48	165	45	8	218	440	55	149	644	963	55	164	1,182	907	50	164	1,121	275	45	135	455
	Net Use	-	40	8	48	165	45	8	218	440	55	149	644	963	55	164	1,182	907	50	164	1,121	275	45	135	455
E Gualala River	Diverted	-	32	5	37	28	36	5	69	74	44	107	225	160	44	117	321	152	40	117	309	46	36	96	178
	Net Use	-	32	5	37	28	36	5	69	74	44	107	225	160	44	117	321	152	40	117	309	46	36	96	178
Hydrographic Unit Totals	Diverted	-	2,022	17	2,039	580	2,275	17	2,872	1,563	2,299	331	4,193	2,783	2,303	365	5,451	2,509	2,291	365	5,165	1,055	2,277	300	3,632
	Net Use	-	2,022	17	2,039	580	2,275	17	2,872	1,563	2,299	331	4,193	2,783	2,303	365	5,451	2,509	2,291	365	5,165	1,055	2,277	300	3,632
MENDOCINO COAST HYDROGRAPHIC UNIT (2020) (Continued)																									
A Rockport	Diverted	-	8	2	10	109	9	2	120	290	11	43	344	633	11	47	691	597	10	47	654	181	9	39	229
	Net Use	-	8	2	10	109	9	2	120	290	11	43	344	633	11	47	691	597	10	47	654	181	9	39	229
B Fort Bragg	Diverted	-	2,880	6	2,886	267	3,240	6	3,513	712	3,240	112	4,064	1,558	3,240	123	4,921	1,468	3,240	123	4,831	445	3,240	101	3,786
	Net Use	-	2,880	6	2,886	267	3,240	6	3,513	712	3,240	112	4,064	1,558	3,240	123	4,921	1,468	3,240	123	4,831	445	3,240	101	3,786
C Navarro River	Diverted	-	21	2	23	690	24	2	716	2,069	30	43	2,142	2,414	36	47	2,497	1,896	33	47	1,976	1,551	27	39	1,617
	Net Use	-	21	2	23	690	24	2	716	2,069	30	43	2,142	2,414	36	47	2,497	1,896	33	47	1,976	1,551	27	39	1,617
D Point Arena	Diverted	-	96	19	115	439	108	19	566	1,170	132	387	1,689	2,558	132	426	3,116	2,412	120	426	2,958	731	108	349	1,188
	Net Use	-	96	19	115	439	108	19	566	1,170	132	387	1,689	2,558	132	426	3,116	2,412	120	426	2,958	731	108	349	1,188
E Gualala River	Diverted	-	64	14	78	56	72	14	142	150	88	275	513	330	88	303	721	310	80	303	693	94	72	248	414
	Net Use	-	64	14	78	56	72	14	142	150	88	275	513	330	88	303	721	310	80	303	693	94	72	248	414
Hydrographic Unit Totals	Diverted	-	3,069	43	3,112	1,561	3,453	43	5,057	4,391	3,501	860	8,752	7,493	3,507	946	11,946	6,683	3,483	946	11,112	3,002	3,456	776	7,234
	Net Use	-	3,069	43	3,112	1,561	3,453	43	5,057	4,391	3,501	860	8,752	7,493	3,507	946	11,946	6,683	3,483	946	11,112	3,002	3,456	776	7,234

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		Annual				October				November				December				January				February				March			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
RUSSIAN RIVER HYDROGRAPHIC UNIT (1990)																													
A Coyote Valley	Diverted	18,420	300	-	18,720	-	24	-	24	-	21	-	21	-	15	-	15	-	12	-	12	-	12	-	12	-	12	-	12
	Net Use	11,973	120	-	12,093	-	10	-	10	-	8	-	8	-	6	-	6	-	5	-	5	-	5	-	5	-	5	-	5
B Forsythe Creek	Diverted	5,330	2,100	21	7,451	-	168	2	170	-	147	1	148	-	126	-	127	-	105	1	106	-	105	1	106	-	105	1	106
	Net Use	3,465	840	-	4,305	-	67	-	67	-	59	-	59	-	50	-	50	-	42	-	42	-	42	-	42	-	42	-	42
C Upper Russian	Diverted	25,990	14,100	21	40,111	-	1,128	2	1,130	-	846	1	847	-	705	1	706	-	564	1	565	-	564	1	565	-	564	1	565
	Net Use	16,893	5,640	-	22,533	-	451	-	451	-	338	-	338	-	282	-	282	-	226	-	226	-	226	-	226	-	226	-	226
D Sulphur Creek	Diverted	140	100	-	240	-	8	-	8	-	7	-	7	-	6	-	6	-	5	-	5	-	5	-	5	-	5	-	5
	Net Use	91	40	-	131	-	3	-	3	-	3	-	3	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
E Middle Russian	Diverted	31,570	1,600	62	33,232	-	128	6	134	-	112	1	113	-	96	1	97	-	80	1	81	-	80	1	81	-	80	1	81
	Net Use	20,520	640	-	21,160	-	51	-	51	-	45	-	45	-	38	-	38	-	32	-	32	-	32	-	32	-	32	-	32
F Santa Rosa	Diverted	5,460	19,100	-	24,560	-	1,528	-	1,528	-	1,337	-	1,337	-	1,146	-	1,146	-	955	-	955	-	955	-	955	-	955	-	955
	Net Use	3,549	7,640	-	11,189	-	611	-	611	-	534	-	534	-	458	-	458	-	382	-	382	-	382	-	382	-	382	-	382
G Laguna	Diverted	26,270	18,100	-	44,370	-	1,448	-	1,448	-	1,267	-	1,267	-	1,086	-	1,086	-	905	-	905	-	905	-	905	-	905	0	905
	Net Use	17,075	7,240	-	24,315	-	579	-	579	-	507	-	507	-	434	-	434	-	362	-	362	-	362	-	362	-	362	-	362
H Mark West	Diverted	18,700	9,700	21	28,421	-	776	2	778	-	679	1	680	-	582	1	583	-	485	1	486	-	485	1	486	-	485	1	486
	Net Use	12,155	3,880	-	16,035	-	310	-	310	-	272	-	272	-	233	-	233	-	194	-	194	-	194	-	194	-	194	-	194
J Dry Creek	Diverted	9,790	1,700	21	11,511	-	136	2	138	-	119	1	120	-	102	1	103	-	85	1	86	-	85	1	86	-	85	1	86
	Net Use	6,364	680	-	7,044	-	54	-	54	-	48	-	48	-	41	-	41	-	34	-	34	-	34	-	34	-	34	-	34
K Austin Creek	Diverted	-	-	411	411	-	-	41	41	-	-	8	8	-	-	4	4	-	-	4	4	-	-	4	4	-	-	4	4
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L Lower Russian	Diverted	19,350	1,800	1,000	22,150	-	144	100	244	-	126	20	146	-	126	10	136	-	126	10	136	-	126	10	136	-	126	10	136
	Net Use	19,350	1,800	1,000	22,150	-	144	100	244	-	126	20	146	-	126	10	136	-	126	10	136	-	126	10	136	-	126	10	136
M Bodega	Diverted	1,820	200	705	2,725	-	16	71	87	-	14	14	28	-	14	7	21	-	14	7	21	-	14	7	21	-	14	7	21
	Net Use	1,820	200	705	2,725	-	16	71	87	-	14	14	28	-	14	7	21	-	14	7	21	-	14	7	21	-	14	7	21
N Walker Creek	Diverted	930	600	705	2,235	-	48	71	119	-	42	14	56	-	42	7	49	-	42	7	49	-	42	7	49	-	42	7	49
	Net Use	930	600	705	2,235	-	48	71	119	-	42	14	56	-	42	7	49	-	42	7	49	-	42	7	49	-	42	7	49
Hydrographic Unit Totals	Diverted	163,770	69,400	2,967	236,137	-	5,552	297	5,849	-	4,717	61	4,778	-	4,046	33	4,079	-	3,378	33	3,411	-	3,378	33	3,411	-	3,378	33	3,411
	Net Use	114,185	29,320	2,410	145,915	-	2,344	242	2,586	-	1,996	48	2,044	-	1,726	24	1,750	-	1,461	24	1,485	-	1,461	24	1,485	-	1,461	24	1,485

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		April				May				June				July				August				September			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
RUSSIAN RIVER HYDROGRAPHIC UNIT (1990) (Continued)																									
A Coyote Valley	Diverted	553	15	-	568	2,210	21	-	2,231	4,605	33	-	4,638	5,526	48	-	5,574	3,316	51	-	3,367	2,210	36	-	2,246
	Net Use	359	6	-	365	1,437	8	-	1,445	2,993	13	-	3,006	3,592	19	-	3,611	2,155	21	-	2,176	1,437	14	-	1,451
B Forsythe Creek	Diverted	160	126	1	287	640	210	1	851	1,332	273	3	1,608	1,599	294	3	1,896	959	252	3	1,214	640	189	3	832
	Net Use	105	50	-	155	416	84	-	500	866	109	-	975	1,039	118	-	1,157	623	101	-	724	416	76	-	492
C Upper Russian	Diverted	780	705	1	1,486	3,119	846	1	3,966	6,497	1,551	3	8,051	7,797	2,397	3	10,197	4,678	2,538	3	7,219	3,119	1,692	3	4,814
	Net Use	507	282	-	789	2,027	338	-	2,365	4,223	620	-	4,843	5,068	959	-	6,027	3,041	1,015	-	4,056	2,027	677	-	2,704
D Sulphur Creek	Diverted	4	6	-	10	17	10	-	27	35	13	-	48	42	14	-	56	25	12	-	37	17	9	-	26
	Net Use	3	2	-	5	11	4	-	15	23	5	-	28	27	6	-	33	16	5	-	21	11	4	-	15
E Middle Russian	Diverted	947	96	1	1,044	3,788	160	1	3,949	7,893	208	12	8,113	9,471	224	13	9,708	5,683	192	13	5,888	3,788	144	11	3,943
	Net Use	616	38	-	654	2,462	64	-	2,526	5,130	83	-	5,213	6,156	90	-	6,246	3,694	77	-	3,771	2,462	58	-	2,520
F Santa Rosa	Diverted	164	1,146	-	1,310	655	1,910	-	2,565	1,365	2,483	-	3,848	1,638	2,674	-	4,312	983	2,292	-	3,275	655	1,719	-	2,374
	Net Use	107	458	-	565	426	764	-	1,190	887	993	-	1,880	1,064	1,071	-	2,135	639	917	-	1,556	426	688	-	1,114
G Laguna	Diverted	788	1,086	-	1,874	3,152	1,810	-	4,962	6,568	2,353	-	8,921	7,881	2,534	-	10,415	4,729	2,172	-	6,901	3,152	1,629	-	4,781
	Net Use	512	434	-	946	2,049	724	-	2,773	4,269	941	-	5,210	5,122	1,014	-	6,136	3,074	869	-	3,943	2,049	652	-	2,701
H Mark West	Diverted	561	582	1	1,144	2,244	970	1	3,215	4,675	1,261	3	5,939	5,610	1,358	3	6,971	3,366	1,164	3	4,533	2,244	873	3	3,120
	Net Use	365	233	-	598	1,459	388	-	1,847	3,038	504	-	3,542	3,646	543	-	4,189	2,188	466	-	2,654	1,459	349	-	1,808
J Dry Creek	Diverted	294	102	1	397	1,175	170	1	1,346	2,447	221	3	2,671	2,937	238	3	3,178	1,762	204	3	1,969	1,175	153	3	1,331
	Net Use	191	41	-	232	764	68	-	832	1,591	88	-	1,679	1,909	95	-	2,004	1,145	82	-	1,227	764	61	-	825
K Austin Creek	Diverted	-	-	4	4	-	-	4	4	-	-	82	82	-	-	91	91	-	-	91	91	-	-	74	74
	Net Use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L Lower Russian	Diverted	580	126	10	716	2,322	144	10	2,476	4,838	180	200	5,218	5,805	216	220	6,241	3,483	198	220	3,901	2,322	162	180	2,664
	Net Use	580	126	10	716	2,322	144	10	2,476	4,838	180	200	5,218	5,805	216	220	6,241	3,483	198	220	3,901	2,322	162	180	2,664
M Bodega	Diverted	-	14	7	21	109	16	7	132	291	20	141	452	637	24	155	816	601	22	155	778	182	18	127	327
	Net Use	-	14	7	21	109	16	7	132	291	20	141	452	637	24	155	816	601	22	155	778	182	18	127	327
N Walker Creek	Diverted	-	42	7	49	56	48	7	111	149	60	141	350	325	72	155	552	307	66	155	528	93	54	127	274
	Net Use	-	42	7	49	56	48	7	111	149	60	141	350	325	72	155	552	307	66	155	528	93	54	127	274
Hydrographic Unit Totals	Diverted	4,831	4,046	33	8,910	19,487	6,315	33	25,835	40,695	8,656	588	49,939	49,268	10,093	646	60,007	29,892	9,163	646	39,701	19,597	6,678	531	26,806
	Net Use	3,345	1,726	24	5,095	13,538	2,650	24	16,212	28,298	3,616	482	32,396	34,390	4,227	530	39,147	20,966	3,839	530	25,335	13,648	2,813	434	16,895

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

RUSSIAN RIVER HYDROGRAPHIC UNIT (2020)

Subunit		Annual				October				November			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
A Coyote Valley	Diverted	14,520	600	-	15,120	-	48	-	48	-	42	-	42
	Net Use	9,437	240	-	9,677	-	19	-	19	-	17	-	17
B Forsythe Creek	Diverted	6,540	4,300	44	10,884	-	344	4	348	-	301	1	302
	Net Use	4,250	1,720	-	5,970	-	138	-	138	-	120	-	120
C Upper Russian	Diverted	25,710	23,600	44	49,354	-	1,888	4	1,892	-	1,416	1	1,417
	Net Use	16,710	9,440	-	26,150	-	755	-	755	-	566	-	566
O Sulphur Creek	Diverted	350	100	-	450	-	8	-	8	-	7	-	7
	Net Use	227	40	-	267	-	3	-	3	-	3	-	3
E Middle Russian	Diverted	32,180	4,000	162	36,342	-	320	16	336	-	280	3	283
	Net Use	20,918	1,600	-	22,518	-	128	-	128	-	112	-	112
F Santa Rosa	Diverted	800	37,900	-	38,700	-	3,032	-	3,032	-	2,653	-	2,653
	Net Use	520	15,160	-	15,680	-	1,213	-	1,213	-	1,061	-	1,061
G Laguna	Diverted	20,720	32,900	-	53,620	-	2,632	-	2,632	-	2,303	-	2,303
	Net Use	13,468	13,160	-	26,628	-	1,053	-	1,053	-	921	-	921
H Mark West	Diverted	14,970	18,700	44	33,714	-	1,496	4	1,500	-	1,309	1	1,310
	Net Use	9,732	7,480	-	17,212	-	598	-	598	-	524	-	524
J Dry Creek	Diverted	8,740	2,600	44	11,384	-	208	4	212	-	182	1	183
	Net Use	5,680	1,040	-	6,720	-	83	-	83	-	73	-	73
K Austin Creek	Diverted	-	100	1,127	1,227	-	8	113	121	-	7	23	30
	Net Use	-	40	-	40	-	3	-	3	-	3	-	3
L Lower Russian	Diverted	26,520	2,400	2,738	31,658	-	192	274	466	-	168	55	223
	Net Use	26,520	2,400	2,738	31,658	-	192	274	466	-	168	55	223
M Bodega	Diverted	11,580	600	1,934	14,114	-	48	194	242	-	42	39	81
	Net Use	11,580	600	1,934	14,114	-	48	194	242	-	42	39	81
N Walker Creek	Diverted	3,350	1,600	1,934	6,884	-	128	194	322	-	112	39	151
	Net Use	3,350	1,600	1,934	6,884	-	128	194	322	-	112	39	151
Hydrographic Unit Totals	Diverted	165,980	129,400	8,071	303,451	-	10,352	807	11,159	-	8,822	163	8,985
	Net Use	122,392	54,520	6,606	183,518	-	4,361	662	5,023	-	3,722	133	3,855

Subunit		December				January				February				March			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
A Coyote Valley	Diverted	-	30	-	30	-	24	-	24	-	24	-	24	-	24	-	24
	Net Use	-	12	-	12	-	10	-	10	-	10	-	10	-	10	-	10
B Forsythe Creek	Diverted	-	258	1	259	-	215	1	216	-	215	1	216	-	215	1	216
	Net Use	-	103	-	103	-	86	-	86	-	86	-	86	-	86	-	86
C Upper Russian	Diverted	-	1,180	1	1,181	-	944	1	945	-	944	1	945	-	944	1	945
	Net Use	-	472	-	472	-	378	-	378	-	378	-	378	-	378	-	378
O Sulphur Creek	Diverted	-	6	-	6	-	5	-	5	-	5	-	5	-	5	-	5
	Net Use	-	2	-	2	-	2	-	2	-	2	-	2	-	2	-	2
E Middle Russian	Diverted	-	240	2	242	-	200	2	202	-	200	2	202	-	200	2	202
	Net Use	-	96	-	96	-	80	-	80	-	80	-	80	-	80	-	80
F Santa Rosa	Diverted	-	2,274	-	2,274	-	1,895	-	1,895	-	1,895	-	1,895	-	1,895	-	1,895
	Net Use	-	910	-	910	-	758	-	758	-	758	-	758	-	758	-	758
G Laguna	Diverted	-	1,974	-	1,974	-	1,645	-	1,645	-	1,645	-	1,645	-	1,645	-	1,645
	Net Use	-	790	-	790	-	658	-	658	-	658	-	658	-	658	-	658
H Mark West	Diverted	-	1,122	1	1,123	-	935	1	936	-	935	1	936	-	935	1	936
	Net Use	-	449	-	449	-	374	-	374	-	374	-	374	-	374	-	374
J Dry Creek	Diverted	-	156	1	157	-	130	1	131	-	130	1	131	-	130	1	131
	Net Use	-	62	-	62	-	52	-	52	-	52	-	52	-	52	-	52
K Austin Creek	Diverted	-	7	11	18	-	7	11	18	-	7	11	18	-	7	11	18
	Net Use	-	3	-	3	-	3	-	3	-	3	-	3	-	3	-	3
L Lower Russian	Diverted	-	168	27	195	-	168	27	195	-	168	27	195	-	168	27	195
	Net Use	-	168	27	195	-	168	27	195	-	168	27	168	-	168	27	195
M Bodega	Diverted	-	42	19	61	-	42	19	61	-	42	19	61	-	42	19	61
	Net Use	-	42	19	61	-	42	19	61	-	42	19	61	-	42	19	61
N Walker Creek	Diverted	-	112	19	131	-	112	19	131	-	112	19	131	-	112	19	131
	Net Use	-	112	19	131	-	112	19	131	-	112	19	131	-	112	19	131
Hydrographic Unit Totals	Diverted	-	7,569	82	7,651	-	6,322	82	6,404	-	6,322	82	6,404	-	6,322	82	6,404
	Net Use	-	3,221	65	3,286	-	2,723	65	2,788	-	2,723	65	2,788	-	2,723	65	2,788

TABLE 121 (Continued)

SUMMARY OF ESTIMATED FUTURE IRRIGATIONAL, MUNICIPLE AND INDUSTRIAL, AND RECREATIONAL WATER REQUIREMENTS

1990 AND 2020

Subunit		April				May				June				July				August				September			
		Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total	Farm irrigation	Municipal and industrial	Recreational	Total
RUSSIAN RIVER HYDROGRAPHIC UNIT (2020) (Continued)																									
A Coyote Valley	Diverted	436	30	-	466	1,742	42	-	1,784	3,630	66	-	3,696	4,356	95	-	4,451	2,614	103	-	2,717	1,742	72	-	1,814
	Net Use	283	12	-	295	1,132	17	-	1,149	2,360	26	-	2,386	2,831	38	-	2,869	1,699	40	-	1,739	1,132	29	-	1,161
B Forsythe Creek	Diverted	196	258	1	455	785	430	1	1,216	1,635	559	8	2,202	1,962	602	9	2,573	1,177	516	9	1,702	785	387	7	1,179
	Net Use	127	103	-	230	510	172	-	682	1,063	224	-	1,287	1,275	241	-	1,516	765	206	-	971	510	155	-	665
C Upper Russian	Diverted	771	1,180	1	1,952	3,085	1,416	1	4,502	6,428	2,596	8	9,032	7,713	4,012	9	11,734	4,628	4,248	9	8,885	3,085	2,832	7	5,924
	Net Use	501	472	-	973	2,005	566	-	2,571	4,179	1,038	-	5,217	5,013	1,605	-	6,618	3,007	1,699	-	4,706	2,005	1,133	-	3,138
D Sulphur Creek	Diverted	11	6	-	17	42	10	-	52	87	13	-	100	105	14	-	119	63	12	-	75	42	9	-	51
	Net Use	7	2	-	9	27	4	-	31	57	5	-	62	68	6	-	74	41	5	-	46	27	4	-	31
E Middle Russian	Diverted	965	240	2	1,207	3,862	400	2	4,264	8,045	520	32	8,597	9,654	560	35	10,249	5,792	480	35	6,307	3,862	360	29	4,251
	Net Use	628	96	-	724	2,510	160	-	2,670	5,228	208	-	5,436	6,277	224	-	6,501	3,765	192	-	3,957	2,510	144	-	2,654
F Santa Rosa	Diverted	24	2,274	-	2,298	96	3,790	-	3,886	200	4,927	-	5,127	240	5,306	-	5,546	144	4,548	-	4,692	96	3,411	-	3,507
	Net Use	16	910	-	926	62	1,516	-	1,578	130	1,971	-	2,101	156	2,122	-	2,278	94	1,819	-	1,913	62	1,364	-	1,426
G Laguna	Diverted	622	1,974	-	2,596	2,486	3,290	-	5,776	5,180	4,277	-	9,457	6,216	4,606	-	10,822	3,730	3,948	-	7,678	2,486	2,961	-	5,447
	Net Use	404	790	-	1,194	1,616	1,316	-	2,932	3,367	1,711	-	5,078	4,040	1,842	-	5,882	2,425	1,579	-	4,004	1,616	1,184	-	2,800
H Mark West	Diverted	449	1,122	1	1,572	1,796	1,870	1	3,667	3,743	2,431	8	6,182	4,491	2,618	9	7,118	2,695	2,244	9	4,948	1,796	1,683	7	3,486
	Net Use	292	449	-	741	1,168	748	-	1,916	2,433	972	-	3,405	2,919	1,047	-	3,966	1,752	898	-	2,650	1,168	673	-	1,841
J Dry Creek	Diverted	262	156	1	419	1,049	260	1	1,310	2,185	338	8	2,531	2,622	364	9	2,995	1,573	312	9	1,894	1,049	234	7	1,290
	Net Use	170	62	-	232	682	104	-	786	1,420	135	-	1,555	1,704	146	-	1,850	1,022	125	-	1,147	682	94	-	776
K Austin Creek	Diverted	-	7	11	18	-	8	11	19	-	10	226	236	-	12	248	260	-	11	248	259	-	9	203	212
	Net Use	-	3	-	3	-	3	-	3	-	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4
L Lower Russian	Diverted	796	168	27	991	3,182	192	27	3,401	6,630	240	548	7,418	7,956	288	603	8,847	4,774	264	603	5,641	3,182	216	493	3,891
	Net Use	796	168	27	991	3,182	192	27	3,401	6,630	240	548	7,418	7,956	288	603	8,847	4,774	264	603	5,641	3,182	216	493	3,891
M Bodega	Diverted	-	42	19	61	695	48	19	762	1,853	60	387	2,300	4,053	72	426	4,551	3,821	66	426	4,313	1,158	54	348	1,560
	Net Use	-	42	19	61	695	48	19	762	1,853	60	387	2,300	4,053	72	426	4,551	3,821	66	426	4,313	1,158	54	348	1,560
N Walker Creek	Diverted	-	112	19	131	201	128	19	348	536	160	387	1,083	1,173	192	426	1,791	1,105	176	426	1,707	335	144	348	827
	Net Use	-	112	19	131	201	128	19	348	536	160	387	1,083	1,173	192	426	1,791	1,105	176	426	1,707	335	144	348	827
Hydrographic Unit Totals	Diverted	4,532	7,569	82	12,183	19,021	11,884	82	30,987	40,152	16,197	1,612	57,961	50,541	18,741	1,774	71,056	32,116	16,928	1,774	50,818	19,618	12,372	1,449	33,439
	Net Use	3,224	3,221	65	6,510	13,790	4,974	65	18,829	29,256	6,754	1,322	37,332	37,465	7,827	1,455	46,747	24,270	7,073	1,455	32,798	14,387	5,198	1,189	20,774

TABLE 122

Summary of Estimated County Water Requirements for 1960*

(in 1,000 acre-feet)

County/Hydrographic Unit	Diverted			Net Use		
	Irrigation	Municipal and industrial	Total	Irrigation	Municipal and industrial	Total
Trinity County						
Trinity River Hydrographic Unit	8.1	1.8	9.9	5.3	0.7	6.0
Mad River-Redwood Creek Hydrographic Unit	-	-	-	-	-	-
Eel River Hydrographic Unit	0.2	-	0.2	0.1	-	0.1
Total	8.3	1.8	10.1	5.4	0.7	6.1
Humboldt County						
Trinity River Hydrographic Unit	1.0	0.6	1.6	0.7	0.2	0.9
Mad River-Redwood Creek Hydrographic Unit	5.5	1.3	6.8	5.4	1.3	6.7
Eel River Hydrographic Unit	28.0	11.6	39.6	27.4	11.5	38.9
Total	34.5	13.5	48.0	33.5	13.0	46.5
Mendocino County						
Eel River Hydrographic Unit	3.3	1.4	4.7	2.1	0.6	2.7
Mendocino Coast Hydrographic Unit	3.2	2.0	5.2	3.2	2.0	5.2
Russian River Hydrographic Unit	28.3	7.3	35.6	18.4	2.9	21.3
Total	34.8	10.7	45.5	23.7	5.5	29.2
Glenn County						
Eel River Hydrographic Unit	-	-	-	-	-	-
Lake County						
Eel River Hydrographic Unit	-	-	-	-	-	-
Russian River Hydrographic Unit	-	-	-	-	-	-
Total	-	-	-	-	-	-
Sonoma County						
Mendocino Coast Hydrographic Unit	-	-	-	-	-	-
Russian River Hydrographic Unit	49.1	14.0	63.1	35.0	5.6	40.6
Total	49.1	14.0	63.1	35.0	5.6	40.6
Marin County						
Russian River Hydrographic Unit	-	-	-	-	-	-
Grand Total	126.7	40.0	166.7	97.6	24.8	122.4

*Table includes only the water requirements of the portions of counties lying within the study area.
The 1960 recreational diversion is estimated to be 6,000 acre-feet for the entire area.

TABLE 123

SUMMARY OF ESTIMATED COUNTY WATER REQUIREMENTS FOR 1990 AND 2020*

(in 1,000 acre-feet)

County/Hydrographic Unit	DIVERTED 1990 Irrigation	DIVERTED 1990 Municipal and industrial	DIVERTED 1990 Recreational	DIVERTED 1990 Total	DIVERTED 2020 Irrigation	DIVERTED 2020 Municipal and industrial	DIVERTED 2020 Recreational	DIVERTED 2020 Total	NET USE 1990 Irrigation	NET USE 1990 Municipal and industrial	NET USE 1990 Recreational	NET USE 1990 Total	NET USE 2020 Irrigation	NET USE 2020 Municipal and industrial	NET USE 2020 Recreational	NET USE 2020 Total
Trinity County																
Trinity River Hydrographic Unit	24.9	3.0	3.1	31.0	29.9	5.2	11.7	46.8	16.2	1.2	-	17.4	19.4	2.1	-	21.5
Mad River-Redwood Creek Hydrographic Unit	0.1	-	-	0.1	0.3	0.1	-	0.4	0.1	-	-	0.1	0.2	-	0.1	0.3
Eel River Hydrographic Unit	0.7	-	0.4	1.1	1.3	-	1.3	2.6	0.5	-	-	0.5	0.9	-	-	0.9
Total	25.7	3.0	3.5	32.2	31.5	5.3	13.0	49.8	16.8	1.2	-	18.0	20.5	2.1	0.1	22.7
Humboldt County																
Trinity River Hydrographic Unit	6.6	0.8	0.6	8.0	8.4	1.1	2.5	12.0	4.3	0.3	-	4.6	5.5	0.4	-	5.9
Mad River-Redwood Creek Hydrographic Unit	18.6	25.7	0.2	44.5	15.6	52.3	0.8	68.7	18.2	25.5	0.2	43.9	14.9	51.9	0.6	67.4
Eel River Hydrographic Unit	58.9	101.2	3.8	163.9	58.1	173.0	14.3	245.4	55.6	100.0	0.8	156.4	54.6	170.4	3.3	228.3
Total	84.1	127.7	4.6	216.4	82.1	226.4	17.6	326.1	78.1	125.8	1.0	204.9	75.0	222.7	3.9	301.6
Mendocino County																
Eel River Hydrographic Unit	26.4	3.6	1.9	31.9	57.5	8.4	7.2	73.1	17.1	1.4	-	18.5	37.4	3.3	-	40.7
Mendocino Coast Hydrographic Unit	8.2	25.2	1.5	34.9	22.4	38.0	3.4	63.8	8.2	25.0	1.5	34.7	22.4	38.0	3.4	63.8
Russian River Hydrographic Unit	50.3	16.5	-	66.8	47.8	28.5	0.1	76.4	32.7	6.6	-	39.3	31.0	11.5	-	42.5
Total	84.9	45.3	3.4	133.6	127.7	74.9	10.7	213.3	58.0	33.0	1.5	92.5	90.8	52.8	3.4	147.0
Glenn County																
Eel River Hydrographic Unit	-	-	-	-	-	-	0.1	0.1	-	-	-	-	-	-	0.1	0.1
Lake County																
Eel River Hydrographic Unit	0.4	-	0.2	0.6	0.7	-	1.0	1.7	0.2	-	-	0.2	0.4	-	-	0.4
Russion River Hydrographic Unit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	0.4	-	0.2	0.6	0.7	-	1.0	1.7	0.2	-	-	0.2	0.4	-	-	0.4
Sonoma County																
Mendocino Coast Hydrographic Unit	0.3	0.1	0.2	0.6	0.7	0.4	0.9	2.0	0.3	0.3	0.2	0.8	0.7	0.4	0.9	2.0
Russion River Hydrographic Unit	112.2	52.3	2.1	166.6	112.6	99.3	5.6	217.5	80.2	22.1	1.6	103.9	87.0	42.6	4.2	133.8
Total	112.5	52.4	2.3	167.2	113.3	99.7	6.5	219.5	80.5	22.4	1.8	104.7	87.7	43.0	5.1	135.8
Marin County																
Russian River Hydrographic Unit	1.3	0.6	0.8	2.7	5.6	1.6	2.4	9.6	1.3	0.6	0.8	2.7	4.4	0.4	2.4	7.2
Grand Total	308.9	229.0	14.8	552.7	360.9	407.9	51.3	820.1	234.9	183.0	5.1	423.0	278.8	321.0	15.0	614.8

* Table includes only the water requirements of the portions of counties lying within the study area.

TABLE 124

FISHERY RESOURCES AND
STREAMFLOW MAINTENANCE REQUIREMENTS
TRINITY RIVER HYDROGRAPHIC UNIT

Hydrographic subunits	Ref. No. plate 2	Fishery resources			Required flows (cfs)		
		King Salmon	Silver Salmon	Steelhead	Oct. 1 to: July 30	August	September
Trinity Reservoir	F-4-A	15,000	500	5,000	325	214	173
Weaver Creek	F-4-B	-0-	200	5,000	10	3	3
Middle Trinity	F-4-C	8,000	1,000	15,000	400	248	207
Helena	F-4-D	3,500	1,000	15,000	500	329	294
New River	F-4-E	2,200	500	15,000	100	67	58
Burnt Ranch	F-4-F	500	500	10,000	700	438	392
Hayfork Valley	F-4-G	-0-	500	10,000	40	36	23
Hayfork Creek	F-4-H	1,300	1,000	15,000	60	46	31
Upper South Fork	F-4-J	13,200	1,000	20,000	70	50	30
Hyampom	F-4-K	2,000	500	5,000	120	96	61
Lower South Fork	F-4-L	1,500	500	10,000	190	132	82
Willow Creek	F-4-M	300	300	5,000	1,100	607	500
Hoopa	F-4-N	2,500	500	10,000	1,200	633	522

TABLE 125

FISHERY RESOURCES AND
STREAMFLOW MAINTENANCE REQUIREMENTS
MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

Hydrographic subunits	Ref. No. plate 2	Fishery resources			Required flows (cfs)				
		King Salmon	Silver Salmon	Steelhead	Oct. 1 to: Apr. 30	May 1 to: June 30	July	Aug.	Sept.
Ruth	F-5-A	-0-	-0-	-0-	120	60	9.4	3.5	2.5
Butler Valley	F-5-B	5,600	500	4,000	650	325	64	30	20
North Fork	F-5-C	700	100	500	100	50	9.5	3.5	3.1
Blue Lake	F-5-D	3,700	1,900	1,500	900	450	85	39	27
Snow Camp	F-5-E	1,000	600	3,000	200	100	31.1	12.3	9.8
Beaver	F-5-F	2,000	800	4,000	600	300	64	35	27
Orick	F-5-G	2,000	600	3,000	900	450	93	55	43
Big Lagoon	F-5-H	-0-	1,500	4,000	1,800	90	22.6	12.2	7.3
Little River	F-5-J	900	1,500	4,000	110	55	12.5	6.7	4.0

TABLE 126

FISHERY RESOURCES AND
STREAMFLOW MAINTENANCE REQUIREMENTS
EEL RIVER HYDROGRAPHIC UNIT

Hydrographic subunits	Ref. No. plate 2	Fishery resources			Required flows (cfs)				
		King Salmon	Silver Salmon	Steelhead	Oct. 16 to: Apr. 30	May 1 to: June 30	July	Aug.	Sept.
Lake Pillsbury1/	F-6-A	3,5002/	-0-	4,000	60	30	33	14	8
Outlet Creek	F-6-B	8,000	-0-	6,000	120	60	15	7.5	4.3
Willis Ridge1/	F-6-C	8,000	-0-	11,000	250	125	62	27	16
Round Valley	F-6-D	3,500	-0-	2,500	80	40	3	3	3
Wilderness	F-6-E	2,000	-0-	8,000	100	50	67	18.5	24
Black Butte River	F-6-F	1,500	-0-	8,000	150	75	7	7	7
Etsel	F-6-G	6,000	-0-	4,500	180	150	81	25	28
North Fork	F-6-H	500	-0-	4,500	100	50	21	9	6
Bell Springs1/	F-6-J	3,000	3,000	6,000	6003/	300	188	73	55
Sequoia1/	F-6-K	3,500	1,500	9,000	6503/	325	207	82	61
Yager Creek	F-6-L	1,000	3,000	4,500	1503/	75	16.3	8.4	5.5
Van Duzen River	F-6-M	3,000	1,000	7,000	1,0003/	500	52.4	22.5	19.8
Larabee Creek	F-6-N	500	1,000	2,000	1303/	65	15.3	8.4	5.6
Laytonville	F-6-P	4,000	8,000	6,000	170	85	10	10	10
Lake Benbow	F-6-Q	10,000	4,000	17,000	3003/	150	75	35	24
Humboldt Redwoods	F-6-R	8,000	500	8,000	4003/	200	60	60	60
Lower Eel1/	F-6-S	6,000	8,000	7,000	2,2003/	1,100	371	155	113
Eureka Plain	F-6-T	2,000	4,000	10,000	-	-	-	-	-
Cape Mendocino	F-6-U	6,000	4,500	18,000	4953/	250	129	80	82

1/ All fish maintenance and enhancement flows on main Eel River are based on full natural flow rather than present impaired flows.
2/ Includes anticipated increase of 3,000 king salmon following relicensing of F.P.C. 77 (Scott Dam).
3/ Fish maintenance flow for fall spawning period begins October 1 rather than October 16. End of summer period changes accordingly.

TABLE 127

FISHERY RESOURCES AND
STREAMFLOW MAINTENANCE REQUIREMENTS
MENDOCINO COAST HYDROGRAPHIC UNIT

Hydrographic subunits	Ref. No. plate 2	Fishery resources			Required flows (cfs)					
		King Salmon	Silver Salmon	Steelhead	Nov. 1 - Apr. 30	May 1 - June 30	July	Aug.	Sept.	Oct.
Rockport	F-8-A	-0-	1,000	5,000	60	30	16	8	7	18
Fort Bragg	F-8-B	-0-	2,000	10,000	160	80	39	22	16	44
Navarro River	F-8-C	-0-	2,000	10,000	130	70	27	16	13	32
Point Arena	F-8-D	-0-	1,000	5,000	45	25	9	6	5	11
Gualala River	F-8-E	-0-	2,000	10,000	300	150	30	16	35	66

TABLE 128

FISHERY RESOURCES AND
STREAMFLOW MAINTENANCE REQUIREMENTS
RUSSIAN RIVER HYDROGRAPHIC UNIT

Hydrographic subunits	Ref. No. plate 2	Fishery resources			Required flows (cfs)					
		King Salmon	Silver Salmon	Steelhead	Nov. 1 to: May 31	June	July	Aug.	Sept.	Oct.
Coyote Valley	F-9-A	-0-	-0-	-0-	90	139	147	149	149	141
Forsythe Creek[1/]	F-9-B	-0-	-0-	3,500	60	11	3	1	1	9
Upper Russian[1/]	F-9-C	1,000	500	12,000	150	150	150	150	150	150
Sulphur Creek	F-9-D	-0-	-0-	4,000	50	20	7	1.5	0.5	9
Middle Russian[1/]	F-9-E	1,000	-0-	7,000	150	150	150	150	150	150
Santa Rosa	F-9-F	-0-	-0-	2,500	30	12	9	7	4	4
Laguna	F-9-G	-0-	-0-	-0-	30	13	10	7	5	4
Mark West	F-9-H	-0-	500	2,500	100	40	31	22	14	14
Dry Creek	F-9-J	-0-	500	8,000	130	41	25	16	11	8
Austin Creek	F-9-K	-0-	2,000	4,000	45	19	15	11	7	6
Lower Russian[1/]	F-9-L	-0-	1,500	6,500	125	125	125	125	125	125
Bodega	F-9-M	-0-	300	3,000	50	21	16	11	7	7
Walker Creek	F-9-N	-0-	200	2,500	30	11	9	7	4	4

1/ Set by agreement between Department of Fish and Game and Sonoma and Mendocino County Flood Control and Water Conservation Districts.

CHAPTER IV

RESULTS AND FINDINGS

Comparison of the present and projected water requirements with the mean seasonal runoff for each of the five hydrographic units considered in the study shows that the water resources are more than adequate to meet all projected water demands in this study area.

The mean seasonal runoff for the entire study area was found to be 18,110,000 acre-feet. It is estimated that agricultural annual net use of water in the study area will increase from 98,000 acre-feet in 1960 to 235,000 acre-feet in 1990 and to 279,000 acre-feet in 2020; and municipal and industrial net use will increase from 25,000 acre-feet in 1960 to 183,000 acre-feet in 1990 and to 321,000 acre-feet in 2020. Fish maintenance requirements are estimated to be constant at the rate of 3,518,000 acre-feet annually. Present exports and presently planned exports, along with reservoir evaporation are estimated to increase to about 1,017,000 acre-feet by 1990 and remain constant through 2020. It is estimated that the net use of water resulting from recreation will be about 15,000 acre-feet by 2020. For more information on these uses see Tables 121 and 129. These uses for the year 2020 are also shown graphically on the frontispiece.

The total mean annual surplus of the entire study area under the conditions described above is estimated to be 13,470,000 acre-feet in 1960, 13,152,000 acre-feet in 1990, and 12,960,000 acre-feet in 2020. The distribution of these surplus quantities

TABLE 129

SUMMARY OF MEAN ANNUAL WATER SUPPLY, PROJECTED FUTURE WATER REQUIREMENTS, AND ESTIMATED NET SURPLUSES FOR 1960, 1990, 2020

(in 1,000 Acre-Feet)

Hydrographic Units and Stream Basins	50 Year Mean Seasonal Runoff	1960		1990		2020		1960	1990	2020	Net Import (+) Net Export (-)			Reservoir Evaporation	Surplus Excluding Fish Maintenance			Fish Maintenance	Surplus Including Fish Maintenance		
		Diversion	Net Use	Diversion	Net Use	Diversion	Net Use				1960	1990	2020		1960	1990	2020		1960	1990	2020
Trinity River	4,171.0	11.5	6.9	39.0	22.0	58.8	27.4	4,164.1	4,149.0	4,143.6	-961.0	-961.0	-961.0	-30.0 Trinity	3,173.1	3,158.0	3,152.6	799.6	2,373.5	2,358.4	2,353.0
Mad River-Redwood Creek																					
Mad River Basin	1,030.3	5.3	5.2	39.2	38.6	60.4	59.0	1,025.1	991.7	971.3	-4.3	-33.9	-54.2	-2.0 Ruth	1,018.8	955.8	915.1	419.5	599.3	536.3	495.6
Redwood Creek Basin	737.3	0.8	0.8	2.1	2.1	2.5	2.5	736.5	735.2	734.8					736.5	735.2	734.8	421.9	314.6	313.3	312.9
Big Lagoon Subunit	197.5	0.3	0.3	2.0	2.0	4.3	4.3	197.2	195.5	193.2					197.2	195.5	193.2	84.6	112.6	110.9	108.6
Little River Subunit	103.7	0.4	0.4	1.3	1.3	1.9	1.9	103.3	102.4	101.8					103.3	102.4	101.8	51.6	51.7	50.8	50.2
Hydrographic Unit Subtotal	2,068.8	6.8	6.7	44.6	44.0	69.1	67.7	2,062.1	2,024.8	2,001.1	-4.3	-33.9	-54.2	-2.0	2,055.8	1,988.9	1,944.9	977.6	1,078.2	1,011.3	967.3
Eel River																					
Eel River Basin	6,298.4	31.2	28.4	110.6	88.8	190.5	138.0	6,270.0	6,209.6	6,160.4	-165.4	-165.4	-165.4	-3.8 Pillsbury	6,100.8	6,040.4	5,991.2	1,044.6	5,056.2	4,995.8	4,946.6
Eureka Plain Subunit	269.0	12.0	12.0	82.3	82.3	124.3	124.3	257.0	186.7	144.7	+4.3	+33.9	+54.2		261.3	220.6	198.9	—	261.3	220.6	198.9
Cape Mendocino Subunit	1,510.5	1.3	1.3	4.6	4.6	8.1	8.1	1,509.2	1,505.9	1,502.4					1,509.2	1,505.9	1,502.4	244.7	1,264.5	1,261.2	1,257.7
Hydrographic Unit Subtotal	8,077.9	44.5	41.7	197.5	175.7	322.9	270.4	8,036.2	7,902.2	7,807.5	-161.1	-131.5	-111.2	-3.8	7,871.3	7,766.9	7,692.5	1,289.3	6,582.0	6,477.6	6,403.2
Mendocino Coast																					
Rockport Subunit	301.9	0.2	0.2	1.7	1.7	2.1	2.1	301.7	300.2	299.8					301.7	300.2	299.8	28.4	273.3	271.8	271.4
Fort Bragg Subunit	552.5	1.9	1.9	25.5	25.5	41.0	41.0	550.6	527.0	511.5					550.6	527.0	511.5	75.1	475.5	451.9	436.4
Navarro River Subunit	346.6	1.4	1.4	2.9	2.9	9.1	9.1	345.2	343.7	337.5					345.2	343.7	337.5	61.0	284.2	282.7	276.5
Point Arena Subunit	279.5	1.7	1.7	4.0	4.0	10.5	10.5	277.8	275.5	269.0					277.8	275.5	269.0	21.2	256.6	245.3	247.8
Gualala River Subunit	623.1	—	—	1.4	1.4	3.1	3.1	623.1	621.7	620.0					623.1	621.7	620.0	135.9	487.2	485.8	484.1
Hydrographic Unit Subtotal	2,103.6	5.2	5.2	35.5	35.5	65.8	65.8	2,098.4	2,068.1	2,037.8					2,098.4	2,068.1	2,037.8	321.6	1,776.8	1,746.5	1,716.2
Russian River																					
Russian River Basin	1,510.1	97.8	61.0	231.2	141.0	282.5	162.5	1,449.1	1,369.1	1,347.6	+164.7	+147.2	+147.2	-2.3 Coyote	1,611.5	1,514.0	1,492.5	90.4	1,521.1	1,423.5	1,402.0
Bodega Subunit	113.6	0.8	0.8	2.7	2.7	14.1	14.1	112.8	110.9	99.5					112.8	110.9	99.5	24.8	88.0	86.2	74.8
Walker Creek Subunit	65.2	0.1	0.1	2.2	2.2	6.9	6.9	65.1	63.0	58.3					65.1	63.0	58.3	14.7	50.4	48.3	43.6
Hydrographic Unit Subtotal	1,688.9	98.7	61.9	236.1	145.9	303.5	183.5	1,627.0	1,543.0	1,505.4	+164.7	+147.2	+147.2	-2.3	1,789.4	1,687.9	1,650.3	129.9	1,659.5	1,558.0	1,520.4
Total Study Area	18,110.2	166.7	122.4	552.7	423.1	820.1	614.8	17,987.8	17,687.1	17,495.4	-961.7	-979.2	-979.2	-38.1	16,988.0	16,669.8	16,478.1	3,518.0	13,470.0	13,151.8	12,960.1

among the five hydrographic units and significant drainage basins is shown in Table 129 for two conditions, one of which fully meets the fish streamflow maintenance requirements at the most downstream subunit. The other condition, presented for comparison only, does not allow for fish streamflow maintenance at the downstream subunits and is therefore, in itself, an unrealistic condition, although the information is valuable in the planning of water resources projects where alternative situations and projects must be considered.

Examination of the monthly distribution of both natural streamflows and projected water requirements of the subunits, however, indicated that most subunits in order to avoid summer deficiencies would require additional reservoir facilities to store winter runoff for later release during months of low flow and high water requirements.

To evaluate these monthly deficiencies, a streamflow routing study was conducted for each of the hydrographic units, in which existing reservoirs were operated as needed for downstream requirements and inter-basin exports.

The routing studies were conducted for each hydrographic unit and subunit on a monthly basis, using the 50-year mean monthly natural runoff quantities developed in Chapter II. Each subunit, beginning with the most upstream areas, was assigned its calculated mean monthly natural contribution to the stream system runoff, which together with all impaired inflow from upstream subunits was compared with the net water uses projected for years 1990 and 2020, and shown in Chapter III.

TABLE 130

SAMPLE COMPUTATION OF MONTHLY ROUTING STUDY
MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

November 1990
(Acre-Feet)

SUBUNIT No.	SUBUNIT Name	Contribution[1]	Diversion Requirement[2]	Return Flow	Net Use Requirement[2]	Export	Net Flow Before Fish Maintenance	Fish Maintenance Requirement[3]	Subunit Surplus (+) or Subunit Deficiency (-)	Inflow: Upstream	Inflow: Import	Subunit Outflow	Stream Basin Accumulated Surplus (+) or Deficiency (-)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
8	Ruth	9,800	1	1	—		9,800	7,200	2,600	0		9,800	2,600
4	Butler Valley	38,300	8	5	3		38,297	39,000	-703	9,800		48,097	9,097
6	North Fork	6,900	14	8	6		6,894	6,000	894	0		6,894	894
3	Blue Lake	6,600	1921	0	1921		4,679	54,000	-49,321	54,991		59,670	5,670
9	Snow Camp	11,700	—	-	—		11,700	12,000	-300	0		11,700	-300
1	Beaver	21,100	—	-	—		21,100	36,000	-14,900	11,700		32,800	-3,200
7	Orick	20,800	15	0	15		20,785	54,000	-33,215	32,800		53,585	-415
2	Big Lagoon	14,000	50	0	50		13,950	10,800	3,150	0		13,950	3,150
5	Little River	7,300	36	0	36		7,264	6,600	664	0		7,264	664

1/ From Table 36
2/ From Table 119
3/ From Table 123
Column (6) = column (1) - column (4) - column (5)
Column (8) = column (6) - column (7)
Column (9) = outflow from upstream subunit if any. (See Figure 2)
Column (11) = column (7) + column (8) + column (9) + column (10)
Column (12) = column (11) - column (7)

In those cases where the total impaired streamflow exceeded the projected net water use, the resultant outflow to the next downstream subunit was tested against the streamflow requirements recommended for fish maintenance at that point, and the surplus or deficiency for that month recorded.

When the subunit's projected monthly net water use exceeded the total monthly water supply, the outflow at the downstream edge of the subunit was considered to be zero, and the deficiency was computed as the sum of the streamflow recommended for fish maintenance and that portion of the net water use which was not satisfied.

Tables of computations of monthly routing studies were too cumbersome to be included in this report; however, a sample computation (Table 130) was included to show how the routing studies were conducted.

A summary of the monthly deficiencies and surpluses obtained from this routing study is presented in Tables 131 through 150. The total seasonal deficiencies in each of these tables represent the amount of water which must be made available to each subunit during the months indicated. These deficiencies are the arithmetic sum of all monthly deficiencies. In every case, except for the Trinity Reservoir Subunit, sufficient quantities of water occur either within the deficient subunit, or upstream therefrom, to enable these deficiencies to be met by seasonal carryover storage. The seasonal summary of net water surplus, also shown in Tables 131 through 150, is the algebraic sum of the monthly surpluses and deficiencies, and thus represents the true seasonal surplus, or quantity which could be developed and exported from the stream system at that point without encroaching upon the net water uses projected for the entire hydrographic unit.

In using these tables, it is imperative to recognize that any modification of either the surplus or deficiencies will affect these quantities in all downstream subunits. Thus, a plan which would develop water to meet all deficiencies, including fish maintenance streamflow requirements, will cause a different inflow to the next downstream subunit, and thereby modify the previously computed surplus or deficiency in that unit. Similarly, development and removal of the indicated net surplus at any point along the stream system will correspondingly reduce those computed for downstream subunits. Further, it must be noted that these surpluses and deficiencies are those which may be expected to occur during the water use conditions estimated to prevail in years 1990 and 2020, if, and only if, the water supplies were to duplicate the mean monthly natural flows which were estimated to have occurred during the 50-year period 1910-11 through 1959-60.

Thus the tables of surplus and deficiencies should be used only as an index of magnitude and location to suggest where future development of the study areas' water resources can, or should occur.

TABLE 131

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

TRINITY RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Trinity Reservoir	-17.5	--	--	--	--	--	--	--	--	--	--	--	- 17.5	17.5
Weaver Creek	- 0.2	0.9	2.8	3.9	7.6	7.7	5.4	4.4	2.2	0.3	--	0.1	35.1	0.2
Middle Trinity	-19.6	3.9	13.5	19.0	39.6	39.5	27.4	22.5	10.4	0.4	- 0.4	- 0.3	155.9	20.3
Helena	-21.5	20.4	36.8	57.2	108.2	109.6	94.3	73.6	36.6	6.8	- 0.9	- 2.5	518.6	24.9
New River	3.0	8.7	36.2	56.4	56.4	76.3	38.7	48.0	19.5	4.1	1.0	0.4	348.5	--
Burnt Ranch	-20.6	29.9	99.0	160.2	200.8	209.4	165.5	138.8	72.5	16.5	- 0.3	- 1.1	1070.6	22.0
Hayfork Valley	- 0.2	6.9	22.9	38.7	58.8	42.2	30.7	11.2	3.2	- 1.5	- 2.2	- 1.7	209.0	5.6
Hayfork Creek	- 0.7	8.7	29.9	50.8	77.3	55.4	40.1	14.5	4.2	- 1.9	- 2.3	- 1.8	274.2	6.7
Upper South Fork	- 1.1	11.7	41.2	76.8	108.3	70.6	59.2	29.1	11.2	1.3	- 0.1	- 0.1	408.1	1.3
Hyampom	- 1.0	22.9	76.8	136.6	199.2	134.9	107.4	47.9	17.6	0.4	- 2.4	- 1.9	738.4	5.3
Lower South Fork	- 4.0	34.6	112.4	180.2	244.5	187.0	150.0	66.4	25.5	0.4	- 2.8	- 2.2	992.1	9.0
Willow Creek	-37.2	57.8	213.5	345.5	452.3	404.5	320.5	200.6	89.6	5.2	- 5.1	- 4.7	2042.5	47.0
Hoopa	-34.8	65.3	246.3	396.5	503.3	473.5	355.6	244.0	106.5	7.8	- 2.6	- 3.0	2358.4	40.4

TABLE 132

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

TRINITY RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Trinity Reservoir	-17.9	--	--	--	--	--	--	--	--	--	--	--	- 17.9	17.9
Weaver Creek	- 0.2	1.0	2.7	3.9	7.6	7.6	5.4	4.4	2.1	0.2	--	--	34.7	0.2
Middle Trinity	-20.0	3.8	13.5	19.0	39.6	39.5	27.4	22.4	10.2	0.2	- 0.6	- 0.5	154.5	21.1
Helena	-21.9	20.3	36.8	57.2	108.2	109.5	94.3	73.5	36.4	6.6	- 1.1	- 2.7	517.1	25.7
New River	3.0	8.7	36.2	56.2	56.4	76.3	38.7	48.0	19.5	4.1	1.0	0.4	348.5	--
Burnt Ranch	-21.0	29.8	99.0	160.2	200.8	209.3	165.4	138.7	72.2	16.1	- 0.7	- 1.4	1068.4	23.1
Hayfork Valley	- 0.3	6.9	22.9	38.7	58.7	42.2	30.7	11.0	2.7	- 2.2	- 2.8	- 2.2	206.3	7.5
Hayfork Creek	- 0.8	8.7	29.8	50.8	77.3	55.4	40.1	14.2	3.6	- 2.6	- 3.0	- 2.4	271.1	8.8
Upper South Fork	- 1.1	11.7	41.3	76.8	108.3	70.6	59.2	29.1	11.2	1.3	- 0.1	- 0.1	408.2	1.3
Hyampom	- 1.0	22.9	76.8	136.6	199.2	134.9	107.4	47.8	17.2	--	- 3.3	- 2.3	736.2	6.6
Lower South Fork	- 4.0	34.6	112.4	180.2	195.2	187.0	150.0	66.2	25.1	- 0.1	- 2.7	- 2.6	941.3	9.4
Willow Creek	-37.6	57.8	213.4	345.5	452.2	404.4	320.5	200.3	88.8	4.2	- 6.1	- 5.5	2037.9	49.2
Hoopa	-35.2	65.3	246.2	396.4	503.2	473.4	355.6	243.6	105.6	6.5	- 3.7	- 3.9	2353.0	42.8

TABLE 133

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

TRINITY RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Trinity Reservoir	2.6	19.5	20.2	20.1	18.2	20.2	19.5	20.1	19.5	20.2	13.2	10.3	203.6	--
Weaver Creek	0.5	1.6	3.4	4.5	8.2	8.3	6.0	5.0	2.8	0.9	0.2	0.3	41.7	--
Middle Trinity	5.2	27.9	38.3	43.8	62.0	64.3	51.4	47.3	34.4	25.2	14.8	12.0	426.6	--
Helena	9.5	50.4	67.8	88.2	136.2	140.6	124.3	104.6	66.6	37.8	19.3	15.0	860.3	--
New River	9.2	14.7	42.4	62.4	62.0	82.5	44.7	54.2	25.5	10.3	5.1	3.8	416.8	--
Burnt Ranch	22.8	71.9	142.4	203.6	240.0	252.8	207.5	182.2	114.5	59.9	26.6	22.2	1546.6	--
Hayfork Valley	2.3	9.3	25.4	41.2	61.0	44.7	33.1	13.7	5.6	1.0	--	-0.3	237.0	0.3
Hayfork Creek	3.0	12.3	33.6	54.5	80.7	59.1	43.7	18.2	7.8	1.8	0.5	--	315.2	--
Upper South Fork	3.2	15.9	45.6	81.2	112.2	74.9	63.4	33.4	15.4	5.6	2.9	1.7	455.4	--
Hyampom	6.5	30.1	84.3	144.1	205.9	142.4	114.6	55.4	24.8	7.9	3.5	1.7	821.0	--
Lower South Fork	7.8	46.0	124.2	192.0	255.3	198.8	161.4	78.2	36.9	12.2	5.3	2.7	1120.8	--
Willow Creek	31.0	123.8	281.7	413.7	513.9	472.7	386.5	268.9	155.6	73.4	32.2	25.0	2778.4	--
Hoopa	39.6	137.3	320.6	470.9	570.5	547.9	427.6	318.4	178.5	82.2	36.4	28.1	3158.0	--

TABLE 134

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

TRINITY RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Trinity Reservoir	2.3	19.5	20.1	20.2	18.2	20.2	19.5	20.1	19.5	20.2	13.1	10.3	203.2	--
Weaver Creek	0.4	1.5	3.4	4.5	8.2	8.3	6.0	5.0	2.7	0.8	0.2	0.2	41.2	--
Middle Trinity	4.8	27.8	38.3	43.8	62.0	64.2	51.4	47.2	34.2	25.0	14.6	11.8	425.1	--
Helena	9.1	50.3	67.8	88.2	136.2	140.5	124.3	104.5	66.4	37.6	19.1	14.8	858.8	--
New River	9.2	14.7	42.4	62.4	62.0	82.5	44.7	54.1	25.5	10.3	5.1	3.8	416.7	--
Burnt Ranch	22.4	71.8	142.4	203.6	240.0	252.7	207.4	182.1	114.2	59.5	26.2	21.9	1544.1	--
Hayfork Valley	2.2	9.2	25.4	41.2	61.0	44.7	33.1	13.4	5.1	0.3	-0.6	-0.8	234.2	1.4
Hayfork Creek	3.0	12.3	33.6	54.5	80.7	59.1	43.7	18.0	7.2	1.1	-0.2	-0.5	312.5	--
Upper South Fork	3.2	15.9	45.6	81.2	112.2	74.9	63.4	33.4	15.4	5.7	3.0	1.7	455.6	--
Hyampom	6.4	30.1	84.3	144.1	205.9	142.4	114.6	55.2	24.4	7.4	3.1	1.4	819.3	--
Lower South Fork	7.7	46.0	124.2	192.0	255.3	198.8	161.4	78.0	36.4	11.7	4.8	2.3	1118.6	--
Willow Creek	30.6	123.8	281.6	413.7	513.8	472.6	386.5	268.5	154.8	72.4	31.3	24.3	2773.9	--
Hoopa	39.2	137.3	320.6	470.8	570.4	547.8	427.6	318.0	177.6	80.9	35.2	27.2	3152.6	--

TABLE 135

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Ruth	- 2.8	2.6	4.1	19.0	38.3	31.7	15.9	6.9	18.4	15.0	8.9	--	158.0	2.8
Butler Valley	-14.3	9.1	67.2	107.6	139.1	91.1	48.3	20.1	14.4	15.7	9.0	0.1	507.4	14.3
North Fork	- 2.4	0.9	11.7	16.4	18.8	11.4	6.1	2.6	- 1.0	- 0.1	- 0.1	- 0.1	64.2	3.7
Blue Lake	-27.0	5.7	85.0	134.6	171.1	108.2	55.3	20.8	--	--	- 6.6	-10.8	536.3	44.4
Snow Camp	4.0	- 0.3	14.7	23.2	18.6	12.7	5.0	8.4	- 0.4	- 0.1	--	--	77.8	4.8
Beaver	-13.1	- 3.2	38.0	55.6	49.6	28.1	9.5	16.3	- 5.6	0.2	--	--	175.4	21.9
Orick	-19.0	- 0.4	66.4	94.5	84.9	48.8	19.6	27.2	- 8.1	0.1	- 0.6	- 0.1	313.3	28.2
Big Lagoon	- 4.2	3.1	26.5	30.2	30.4	12.6	9.3	5.8	- 2.0	- 0.3	- 0.3	- 0.2	110.9	7.0
Little River	- 2.8	0.7	12.9	14.9	15.1	5.7	4.0	2.5	- 1.5	- 0.3	- 0.2	- 0.2	50.8	5.0

TABLE 136

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Ruth	- 2.8	2.6	4.0	18.9	38.0	31.8	15.9	6.9	23.6	18.7	--	--	157.6	2.8
Butler Valley	- 14.3	9.1	67.2	107.6	137.8	91.1	48.3	20.0	19.6	19.3	-0.1	--	505.6	14.4
North Fork	- 2.4	0.9	11.7	16.4	18.6	11.4	6.1	2.5	-1.0	-0.1	-2.6	-0.1	61.4	6.2
Blue Lake	- 33.0	3.7	83.0	132.6	169.3	106.4	53.3	16.5	--	-0.2	-19.6	-16.4	495.6	69.2
Snow Camp	- 4.0	-0.3	14.7	23.2	18.2	12.7	5.0	8.3	-0.4	-0.1	--	--	77.3	4.8
Beaver	- 13.1	-3.2	38.0	55.6	48.4	28.1	9.5	16.3	-5.7	0.2	--	--	174.1	22.0
Orick	- 19.1	-0.5	66.4	94.6	84.8	48.7	19.6	27.2	-8.2	0.1	-0.6	-0.1	312.9	28.5
Big Lagoon	- 4.3	3.1	26.4	30.1	30.3	12.5	9.3	5.7	-2.3	-0.9	-0.9	-0.4	108.6	8.8
Little River	- 2.8	0.6	12.9	14.9	15.1	5.6	3.9	2.4	-1.6	-0.3	-0.3	-0.2	50.2	5.2

TABLE 137

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Ruth	1.1	9.8	11.5	26.4	45.0	39.2	23.1	10.6	22.6	15.5	9.2	0.2	213.6	--
Butler Valley	7.1	48.1	107.5	147.9	175.5	131.4	87.3	40.2	32.5	19.7	10.8	1.3	809.3	--
North Fork	0.9	6.9	17.9	22.6	24.4	17.6	12.1	5.7	2.0	0.5	0.2	0.1	110.9	--
Blue Lake	2.6	59.7	140.8	190.4	221.6	164.0	109.3	48.6	27.0	5.2	- 4.2	- 9.2	955.8	13.4
Snow Camp	2.6	11.7	27.1	35.6	29.8	25.1	17.0	14.6	5.6	1.8	0.8	0.6	172.3	--
Beaver	6.6	32.8	75.2	92.8	83.2	65.3	45.5	34.9	12.4	4.1	2.2	1.7	456.7	--
Orick	10.6	53.6	122.2	150.4	135.3	104.6	73.6	55.0	18.9	5.8	2.8	2.4	735.2	--
Big Lagoon	1.7	13.9	37.7	41.3	40.5	23.7	20.2	11.4	3.4	1.1	0.4	0.2	195.5	--
Little River	0.8	7.2	19.6	21.7	21.6	12.5	10.5	5.9	1.8	0.5	0.2	0.1	102.4	--

TABLE 138

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

MAD RIVER-REDWOOD CREEK HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Ruth	1.1	9.8	11.5	26.4	45.0	39.2	23.1	10.5	27.2	19.3	0.1	0.2	213.4	--
Butler Valley	7.1	48.1	107.5	147.9	175.5	131.4	87.3	40.2	37.6	23.3	1.7	1.2	808.8	--
North Fork	0.9	6.9	17.9	22.6	24.4	17.6	12.1	5.7	2.0	0.5	0.2	0.1	110.9	--
Blue Lake	-3.4	57.7	138.8	188.5	219.6	162.2	107.3	44.4	27.0	5.0	-17.2	-14.8	915.1	32.0
Snow Camp	2.6	11.7	27.1	35.6	29.8	25.1	17.0	14.6	5.5	1.8	0.8	0.6	172.2	--
Beaver	6.6	32.8	75.2	92.8	83.2	65.3	45.5	34.9	12.3	4.1	2.1	1.7	456.5	--
Orick	10.5	53.6	122.2	150.3	135.3	104.5	73.6	55.0	18.8	5.8	2.8	2.4	734.8	--
Big Lagoon	1.6	13.9	37.6	41.3	40.4	23.7	20.0	11.2	3.1	0.5	- 0.1	--	193.2	-0.1
Little River	0.8	7.2	19.7	21.7	21.2	12.4	10.5	5.9	1.8	0.4	0.2	--	101.8	--

TABLE 139

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

EEL RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Lake Pillsbury	- 2.4	--	--	32.6	91.2	54.1	36.4	7.8	0.4	17.7	9.8	- 0.5	247.1	2.9
Outlet Creek	- 0.9	6.6	34.9	54.9	54.8	32.6	17.5	5.6	- 1.6	- 1.5	- 1.3	- 0.9	200.7	6.2
Willis Ridge	- 4.7	17.6	77.1	151.7	209.7	126.2	76.7	21.9	--	16.0	8.4	- 1.4	699.2	6.1
Round Valley	- 2.4	0.5	11.3	17.1	41.8	26.7	17.7	3.3	- 3.5	- 2.4	- 1.9	- 1.6	106.6	11.8
Wilderness	- 0.3	13.1	43.2	55.5	73.2	59.7	63.8	34.9	8.5	- 1.6	- 0.4	- 0.5	349.1	2.8
Black Butte	- 2.8	1.8	18.8	25.8	36.4	28.1	30.6	16.9	2.1	0.9	--	0.1	158.7	2.8
Etsel	1.9	41.2	133.1	180.2	211.3	153.8	143.0	69.4	13.5	- 1.9	- 1.9	- 1.3	942.3	5.1
North Fork	- 0.6	15.5	57.1	87.6	85.8	54.4	31.7	12.9	2.1	0.1	--	0.1	346.7	0.6
Bell Springs	- 2.5	90.9	322.5	508.8	595.7	392.3	287.3	121.7	21.8	14.0	6.6	- 2.5	2356.6	5.0
Sequoia	- 2.7	102.0	374.1	599.3	688.6	452.9	324.6	137.7	26.3	14.6	6.5	- 2.4	2721.5	5.1
Yager Creek	- 2.8	8.6	48.6	53.5	48.4	28.9	18.4	3.9	- 1.4	0.1	0.2	--	206.4	4.2
Van Duzen River	-22.1	11.0	109.3	151.4	151.1	79.8	44.1	16.1	-14.8	- 0.8	- 0.9	- 0.3	523.9	38.9
Larabee Creek	- 3.3	- 0.5	19.9	40.1	41.9	24.7	12.9	4.9	- 0.8	--	- 0.3	- 0.1	139.4	5.0
Laytonville	- 3.1	7.4	39.3	62.9	59.7	36.1	18.7	6.7	- 1.6	0.1	- 0.6	- 0.5	225.1	5.8
Lake Benbow	0.2	47.9	168.4	261.0	251.2	159.6	94.0	36.5	6.5	- 0.2	- 0.3	0.2	1025.0	0.5
Humboldt-Redwoods	- 1.3	56.4	218.0	350.9	343.6	218.6	129.2	51.4	9.6	2.4	- 1.5	- 1.5	1375.8	4.3
Lower Eel	-30.5	177.0	760.8	1211.6	1297.4	822.5	539.1	218.8	16.1	--	- 9.1	- 7.7	4995.8	47.3
Eureka Plain	--	12.0	50.4	55.0	50.0	31.3	20.7	1.2	--	--	--	--	220.6	--
Cape Mendocino	1.2	104.7	215.9	325.5	276.9	159.2	115.6	55.7	7.8	- 3.9	3.0	- 0.4	1261.2	4.3

TABLE 140

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

EEL RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Lake Pillsbury	20.0	--	25.8	55.5	71.2	34.0	27.7	7.8	1.8	- 1.5	4.6	--	246.9	1.5
Outlet Creek	- 1.0	6.6	34.8	54.8	54.8	32.5	17.4	5.1	- 2.9	- 3.0	- 2.4	- 1.9	194.8	11.2
Willis Ridge	-22.4	17.6	102.8	174.5	189.7	106.1	67.9	21.4	--	- 4.8	1.8	- 2.1	692.5	29.3
Round Valley	- 2.4	0.5	11.3	17.1	41.7	26.6	17.7	2.3	- 6.3	- 5.5	- 4.5	- 3.7	94.8	22.4
Wilderness	- 0.3	13.1	43.2	55.5	73.2	59.7	63.8	34.9	8.5	- 1.6	- 0.4	- 0.5	349.1	2.8
Black Butte	- 2.9	1.8	18.8	25.8	36.4	28.1	30.6	16.9	2.1	1.0	--	0.1	158.7	2.9
Etsel	1.9	41.1	133.1	180.2	211.3	153.8	142.9	68.3	10.5	- 5.4	- 4.7	- 3.6	929.4	13.7
North Fork	- 0.6	15.5	57.1	87.6	85.8	54.4	31.7	12.9	2.1	0.1	- 0.1	--	346.5	0.7
Bell Springs	9.8	90.8	348.3	531.5	575.6	372.2	278.5	120.1	18.8	-10.4	- 3.0	- 5.5	2326.7	18.9
Sequoia	19.6	101.9	399.8	622.1	668.5	432.8	315.8	136.1	23.2	-10.0	- 3.2	- 5.4	2701.2	18.6
Yager Creek	- 2.8	8.6	48.6	53.5	48.4	28.9	18.4	3.9	- 1.4	--	0.2	- 0.1	206.2	4.3
Van Duzen River	-22.1	11.0	109.2	151.3	151.0	79.8	44.1	16.0	-15.1	- 1.7	- 1.4	- 0.4	521.7	40.7
Larabee Creek	- 3.3	- 0.5	19.9	40.0	41.9	24.7	12.9	5.0	- 0.8	--	- 0.3	- 0.1	139.4	5.0
Laytonville	- 3.1	7.4	39.3	62.9	59.7	36.2	18.7	6.5	- 2.2	- 0.6	- 1.2	- 1.0	222.4	8.1
Lake Benbow	0.1	47.8	168.3	261.0	251.1	159.5	93.9	36.3	6.1	- 0.6	- 0.7	- 0.1	1022.7	1.4
Humboldt Redwoods	8.6	56.3	218.0	350.8	343.6	218.5	129.2	51.2	9.3	2.0	- 1.7	- 1.7	1384.1	3.4
Lower Eel	-10.7	175.0	784.4	1232.3	1275.4	800.3	528.2	214.6	10.0	-27.6	-21.7	-13.6	4946.6	73.6
Eureka Plain	0	8.9	46.8	51.5	46.9	27.7	17.1	--	--	--	--	--	198.9	--
Cape Mendocino	1.1	104.6	215.9	325.5	276.9	159.2	115.6	55.5	7.0	- 4.8	2.2	- 1.0	1257.7	5.8

TABLE 141

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

EEL RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Lake Pillsbury	--	3.6	3.7	36.3	94.6	57.8	40.0	9.6	2.2	19.8	10.7	--	278.3	--
Outlet Creek	2.0	13.8	42.3	62.3	61.6	40.0	24.6	9.3	2.0	- 0.6	- 0.8	-0.7	256.8	2.1
Willis Ridge	4.3	32.6	92.6	167.2	223.7	141.7	91.7	29.7	7.5	20.0	10.1	-0.5	820.5	--
Round Valley	0.2	3.0	13.9	19.7	44.1	29.2	20.2	5.7	- 1.1	- 2.2	- 1.8	-1.4	129.5	6.5
Wilderness	3.6	19.1	49.4	61.7	78.8	65.9	69.8	38.0	11.5	2.5	0.7	0.9	401.9	--
Black Butte	.2.0	10.8	28.1	35.1	44.8	37.4	39.6	21.6	6.6	1.4	0.4	0.5	228.3	--
Etsel	.8.9	52.0	144.3	191.4	221.4	165.0	153.8	78.7	22.5	3.1	-0.3	0.3	1041.1	0.3
North Fork	3.0	21.5	63.3	93.8	91.4	60.6	37.7	16.0	5.1	1.4	0.5	0.4	394.7	--
Bell Springs	19.2	126.9	359.7	545.9	629.3	429.5	323.3	140.3	39.8	25.7	11.0	0.8	2651.4	--
Sequoia	21.2	141.0	414.4	639.6	725.0	493.2	363.6	157.9	45.8	27.3	11.5	1.3	3041.8	--
Yager Creek	2.2	17.6	57.9	62.8	56.8	38.2	27.4	8.6	3.1	1.1	0.7	0.3	276.7	--
Van Duzen River	10.0	71.0	171.3	213.4	207.1	141.8	104.1	47.1	15.2	2.5	0.5	0.9	984.6	--
Larabee Creek	1.0	7.3	28.0	48.1	49.2	32.7	20.7	9.0	3.1	0.9	0.3	0.3	200.6	--
Laytonville	2.5	17.6	49.8	73.4	69.2	46.7	28.9	11.9	3.6	0.8	--	0.1	304.5	--
Lake Benbow	10.9	65.9	187.0	279.7	268.0	178.2	112.0	45.9	15.5	4.5	1.8	1.6	1171.0	--
Humboldt Redwoods	12.9	80.3	242.9	375.7	366.0	243.4	153.2	63.8	21.6	6.1	2.3	2.1	1570.3	--
Lower Eel	44.4	309.0	897.2	1348.0	1420.6	958.9	671.1	287.0	82.1	22.8	0.3	-1.0	6040.4	8.9
Eureka Plain	--	12.0	50.3	55.1	50.0	31.3	20.7	1.2	--	--	--	--	220.6	--
Cape Mendocino	17.5	134.4	246.6	356.2	305.6	189.9	145.3	71.2	22.8	4.0	7.9	4.5	1505.9	--

TABLE 142

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

EEL RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Lake Pillsbury	22.4	3.6	29.6	59.2	74.6	37.7	31.3	9.6	3.6	0.5	5.4	0.5	278.0	--
Outlet Creek	1.9	13.8	42.3	62.3	61.5	40.0	24.5	8.9	0.7	- 2.0	- 2.0	- 1.7	250.2	5.7
Willis Ridge	26.6	32.6	118.3	190.0	203.7	121.6	82.8	29.1	7.5	1.0	- 3.4	- 1.2	813.4	-3.6
Round Valley	0.1	2.9	13.9	19.7	44.0	29.1	20.1	4.8	-3.9	-5.5	- 4.3	- 3.6	117.3	17.3
Wilderness	3.6	19.1	49.4	61.7	78.8	65.9	69.8	38.0	11.5	2.5	0.7	0.9	401.9	--
Black Butte	2.0	10.8	28.1	35.1	44.8	37.4	39.6	21.6	6.6	1.4	0.4	0.5	228.3	--
Etsel	8.8	51.9	144.3	191.3	221.4	165.0	153.7	77.6	19.5	- 0.4	- 3.1	- 2.0	1028.0	5.5
North Fork	3.0	21.5	63.3	93.8	91.4	60.6	37.7	15.9	5.1	1.4	0.5	0.4	394.6	--
Bell Springs	41.5	126.8	385.5	568.7	609.2	409.4	314.5	138.7	36.8	1.1	1.5	- 2.2	2631.5	2.2
Sequoia	43.4	140.9	440.1	662.4	704.9	473.1	354.8	156.2	42.7	2.7	1.9	- 1.8	3021.4	1.8
Yager Creek	2.2	17.6	57.9	62.8	56.8	38.4	27.4	8.6	3.1	1.0	0.6	0.3	276.5	--
Van Duzen River	9.9	71.0	171.2	213.3	207.1	141.8	104.1	47.0	14.9	2.0	--	0.8	983.1	--
Larabee Creek	1.0	7.3	28.0	48.1	49.2	32.7	20.7	9.0	3.1	0.8	0.3	0.3	200.5	--
Laytonville	2.5	17.6	49.8	73.4	69.2	46.7	28.9	11.7	2.9	--	- 0.6	- 0.4	301.7	1.0
Lake Benbow	10.8	65.8	186.9	279.6	267.9	178.1	111.9	45.6	15.1	4.0	1.5	1.3	1168.5	--
Humboldt Redwoods	12.9	80.3	242.8	375.6	366.0	243.3	153.2	63.6	21.3	5.7	2.0	1.9	1568.6	--
Lower Eel	64.2	307.0	920.8	1368.6	1398.6	936.7	660.2	282.8	76.1	- 4.7	-12.2	- 6.9	5991.2	23.8
Eureka Plain	--	8.9	46.8	51.5	46.9	27.7	17.1	--	--	--	--	--	198.9	--
Cape Mendocino	17.4	134.4	246.6	356.2	305.6	189.9	145.3	71.0	22.0	3.1	7.1	3.8	1502.4	--

TABLE 143

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

MENDOCINO COAST HYDROGRAPHIC UNIT
(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Rockport	1.3	7.0	42.5	70.6	62.1	47.3	27.5	9.8	3.0	0.2	0.2	0.3	271.8	--
Fort Bragg	-0.3	7.8	72.7	124.0	109.0	81.9	45.4	14.3	2.2	-1.7	-1.8	-1.6	451.9	5.4
Navarro River	0.4	2.6	40.1	76.5	80.4	49.4	28.3	7.3	-0.4	-0.7	-0.6	-0.6	282.7	2.3
Point Arena	1.4	6.7	37.4	65.1	65.9	41.9	27.8	8.3	1.3	-0.6	-0.9	--	254.3	1.5
Gualala River	2.0	5.6	74.2	131.6	130.3	76.7	53.6	14.3	-2.3	-0.3	-0.1	0.2	485.8	2.7

TABLE 144

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

MENDOCINO COAST HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Rockport	1.3	7.0	42.5	70.6	62.0	47.3	27.5	9.8	2.9	0.1	0.1	0.3	271.4	--
Fort Bragg	-1.3	5.8	71.7	123.1	107.7	81.1	44.4	13.1	0.5	-4.0	-4.0	-3.1	436.4	12.2
Navarro River	0.4	2.6	40.0	76.5	80.2	49.5	28.3	6.8	-1.8	-2.5	-1.9	-1.6	276.5	7.8
Point Arena	1.3	6.7	37.3	65.0	65.8	41.8	27.7	8.0	0.2	-2.6	-2.7	-0.7	247.8	6.0
Gualala River	2.0	5.7	74.2	131.6	129.7	76.7	53.6	14.3	-2.6	-0.7	-0.4	--	484.1	3.7

TABLE 145

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

MENDOCINO COAST HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Rockport	2.4	10.6	46.2	74.3	65.5	51.0	31.1	11.7	4.8	1.2	0.7	0.7	300.2	--
Fort Bragg	2.4	17.4	82.5	134.0	118.0	91.8	55.0	19.2	7.0	0.7	-0.4	-0.6	527.0	1.0
Navarro River	2.3	10.4	48.2	84.6	87.7	57.5	36.1	11.6	3.8	0.9	0.4	0.2	343.7	--
Point Arena	2.1	9.4	40.2	67.9	68.4	44.7	30.4	9.9	2.8	-0.1	-0.5	0.3	275.5	0.6
Gualala River	6.1	23.7	92.7	150.1	147.1	95.3	71.6	23.6	6.7	1.6	0.9	2.3	621.7	--

TABLE 146

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

MENDOCINO COAST HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Rockport	2.4	10.6	46.2	74.3	65.5	51.0	31.1	11.7	4.7	1.1	0.5	0.7	299.8	-
Fort Bragg	1.5	16.4	81.6	133.0	117.0	91.0	54.0	18.0	5.3	-1.6	-2.6	-2.1	511.5	6.3
Navarro River	2.3	10.4	48.2	84.6	87.7	57.5	36.1	11.1	2.3	-0.8	-1.0	-0.9	337.5	2.7
Point Arena	1.9	9.4	40.1	67.8	68.4	44.6	30.4	9.5	1.7	-2.0	-2.4	-0.4	269.0	4.8
Gualala River	6.0	23.6	92.7	150.1	147.0	95.2	71.6	23.6	6.4	1.2	0.5	2.1	620.0	-

TABLE 147

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

RUSSIAN RIVER HYDROGRAPHIC UNIT
(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Coyote Valley	--	--	--	10.9	34.4	25.1	15.8	8.3	11.7	20.2	12.5	7.3	146.2	--
Forsythe Creek	0.1	- 0.8	14.3	25.3	27.1	14.4	7.3	- 1.3	- 0.8	- 1.1	- 0.7	- 0.5	83.3	5.2
Upper Russian	0.6	7.9	49.2	96.9	128.9	85.9	52.3	13.1	6.7	13.0	7.9	4.2	466.6	--
Sulphur Creek	--	0.4	10.7	17.4	24.2	15.4	7.1	0.8	--	- 0.1	--	0.1	75.8	0.2
Middle Russian	2.3	19.6	92.3	161.2	214.8	143.7	83.4	22.5	5.4	8.1	4.3	1.8	759.4	--
Santa Rosa	0.4	- 0.5	8.5	12.8	17.7	10.5	5.4	- 0.1	0.2	0.4	0.8	0.8	56.9	0.6
Laguna	-0.5	- 1.2	8.6	13.2	18.5	10.6	5.2	- 2.7	- 4.8	- 5.6	- 3.5	- 2.4	35.4	20.7
Mark West	-0.3	- 2.9	27.4	41.6	58.0	33.4	16.9	- 4.9	- 7.6	- 8.8	- 4.8	- 3.0	145.0	32.3
Dry Creek	-0.2	- 0.7	30.5	48.8	60.9	35.6	16.1	- 1.2	- 2.0	- 2.9	- 1.9	- 1.3	181.9	10.0
Austin Creek	-0.1	- 1.1	13.2	19.8	27.7	15.9	8.9	- 0.2	0.2	0.4	0.2	0.2	85.1	1.4
Lower Russian	3.4	32.0	203.0	320.9	422.7	271.9	158.3	32.2	- 5.4	- 7.3	- 5.0	- 3.2	1423.5	20.9
Bodega	-0.2	- 1.3	13.8	20.9	29.2	16.7	9.2	- 0.4	- 0.3	- 0.4	- 0.5	- 0.5	86.2	3.6
Walker Creek	-0.2	- 0.8	7.8	11.9	16.5	9.5	5.1	- 0.4	- 0.2	- 0.3	- 0.4	- 0.2	48.3	2.5

TABLE 148

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

RUSSIAN RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Coyote Valley	--	9.8	0.9	--	--	13.1	15.9	8.6	19.4	26.7	10.5	9.0	113.9	--
Forsythe Creek	--	- 0.8	14.2	25.2	27.1	14.3	7.3	- 1.5	- 1.2	- 1.5	- 0.9	- 0.6	81.6	6.5
Upper Russian	0.3	13.4	49.8	90.1	128.7	76.7	52.1	13.0	13.8	18.6	5.0	5.4	466.9	--
Sulphur Creek	-0.1	0.4	10.7	17.4	24.2	15.4	7.1	0.8	- 0.1	- 0.1	--	- 0.1	75.6	0.4
Middle Russian	1.8	24.0	92.9	154.4	214.6	131.4	83.1	22.3	12.2	13.3	1.2	2.8	754.0	--
Santa Rosa	-0.2	- 1.0	8.1	12.4	17.4	10.1	5.1	- 0.6	--	0.3	0.5	0.5	52.4	1.8
Laguna	-0.9	- 1.4	8.3	12.9	18.2	10.3	4.9	- 2.9	- 4.7	- 5.4	- 3.6	2.5	38.2	18.9
Mark West	-1.7	- 4.2	26.4	40.7	57.1	32.6	16.2	- 5.5	- 7.6	- 8.4	- 5.2	- 3.5	136.9	36.1
Dry Creek	0.2	- 0.7	30.4	48.8	60.9	35.5	16.1	- 1.2	- 1.9	- 2.8	- 1.8	- 1.2	182.3	9.6
Austin Creek	-0.1	- 1.1	13.2	19.8	27.7	15.9	8.9	- 0.2	0.2	0.4	0.2	0.2	85.1	1.4
Lower Russian	1.3	36.0	202.6	313.1	421.6	258.7	157.0	30.5	- 0.7	- 4.1	-10.2	- 3.8	1402.0	18.8
Bodega	-0.4	- 1.4	13.8	20.8	29.1	16.6	9.1	- 1.0	- 2.0	- 4.1	- 4.0	- 1.7	74.8	14.6
Walker Creek	-0.4	- 1.0	7.7	11.7	16.4	9.4	5.1	- 0.6	- 0.9	- 1.5	- 1.5	- 0.8	43.6	6.7

TABLE 149

MEAN SURPLUS OR DEFICIENCY - 1990 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

RUSSIAN RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Coyote Valley	8.7	9.4	5.4	16.3	39.8	30.5	21.2	13.7	20.0	29.3	21.6	16.1	232.0	--
Forsythe Creek	0.6	2.8	17.9	28.9	30.8	17.9	10.9	2.3	- 0.2	- 0.9	- 0.6	- 0.4	110.0	2.1
Upper Russian	9.9	16.9	58.2	105.9	137.9	94.9	61.3	22.1	15.7	22.3	17.1	13.1	575.3	--
Sulphur Creek	0.5	3.4	13.7	20.4	27.2	18.4	10.1	3.8	1.2	0.3	0.1	--	99.1	--
Middle Russian	11.5	27.6	101.3	170.2	223.8	152.7	92.4	31.5	14.3	17.3	13.5	10.7	866.8	--
Santa Rosa	0.6	1.3	10.3	14.6	19.6	12.3	7.2	1.6	1.0	0.9	1.3	1.0	71.7	--
Laguna	-0.3	0.6	10.4	15.0	20.3	12.4	7.0	- 0.9	- 4.0	- 5.0	- 3.1	- 2.1	50.3	15.4
Mark West	0.6	3.0	33.4	47.6	64.0	39.4	23.0	1.1	- 5.2	- 6.9	- 3.5	- 2.2	194.3	17.8
Dry Creek	1.3	7.1	38.2	56.6	68.7	43.4	23.9	6.6	0.4	- 1.4	- 0.9	- 0.6	243.3	2.9
Austin Creek	0.3	1.6	15.9	22.5	30.4	18.6	11.6	2.5	1.3	1.3	0.9	0.6	107.5	--
Lower Russian	11.1	39.5	210.5	328.4	430.3	279.4	165.8	39.7	2.0	0.4	2.7	4.2	1514.0	--
Bodega	0.2	1.6	16.8	23.9	32.2	19.7	12.2	2.6	0.9	0.6	0.2	--	110.9	--
Walker Creek	0.1	0.9	9.6	13.7	18.4	11.2	6.9	1.4	0.4	0.3	0.1	--	63.0	--

TABLE 150

MEAN SURPLUS OR DEFICIENCY - 2020 WATER REQUIREMENTS
EXCLUDING FISH MAINTENANCE STREAMFLOW REQUIREMENTS

RUSSIAN RIVER HYDROGRAPHIC UNIT

(In 1000 Acre-Feet)

Hydrographic subunit	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Net season surplus	Total season deficiency
Coyote Valley	8.7	15.2	6.3	9.7	39.8	18.5	21.3	14.0	27.7	35.8	19.6	17.9	234.5	--
Forsythe Creek	0.6	2.8	17.8	28.8	30.7	17.9	10.9	2.1	- 0.5	- 1.3	- 0.9	- 0.5	180.4	3.2
Upper Russian	9.5	22.4	58.8	99.1	137.7	82.6	61.1	22.0	22.7	27.8	14.2	14.3	572.2	--
Sulphur Creek	0.5	3.4	13.7	20.4	27.2	18.4	10.1	3.8	1.1	0.3	--	--	98.9	--
Middle Russian	11.0	33.0	101.9	163.4	223.6	140.4	92.1	31.2	21.1	22.6	10.4	11.7	862.4	--
Santa Rosa	0.1	0.8	9.9	14.2	19.2	11.9	6.8	1.2	0.7	0.8	0.9	0.7	67.2	--
Laguna	-0.7	0.2	10.1	14.7	20.0	12.1	6.7	- 1.1	- 3.9	- 4.7	- 3.2	- 2.2	48.0	15.8
Mark West	-0.8	1.8	32.4	46.7	63.2	38.6	22.2	0.5	- 5.2	- 6.5	- 3.9	- 2.6	186.4	19.0
Dry Creek	1.3	7.1	38.2	56.6	68.6	43.3	23.9	6.6	0.6	- 1.2	- 0.8	- 0.6	243.6	2.7
Austin Creek	0.3	1.6	15.9	22.5	30.4	18.6	11.6	2.5	1.3	1.3	0.9	0.6	107.5	--
Lower Russian	9.0	43.5	210.1	320.6	429.1	266.2	164.5	38.0	6.8	3.6	2.5	3.6	1492.5	--
Bodega	0.1	1.6	16.8	23.8	32.2	19.6	12.2	1.9	- 0.9	- 3.2	- 3.3	- 1.3	99.5	8.6
Walker Creek	-0.1	0.8	9.5	13.6	18.3	11.2	6.9	1.0	- 0.3	- 1.0	- 1.1	- 0.5	58.3	3.0

APPENDIX A

BIBLIOGRAPHY

APPENDIX A

BIBLIOGRAPHY

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F 4 TRINITY RIVI

Subunits

A Trinity Reserv
B Weaver Creek
C Middle Trinity
D Helena
E New River
F Burnt Ranch
G Hayfork Valley
H Hayfork Creek
J Upper So. Fork
K Hyampom
L Lower So. For
M Willow Creek
N Hoopa

F 6 EEL RIVER

Subunits

A Lake Pillsbury
B Outlet Creek
C Willis Ridge
D Round Valley
E Wilderness
F Black Butte
G Etsel
H North Fork
J Bell Springs
K Sequoia
L Yager Creek
M Van Duzen Riv
N Larabee Creek
P Laytonville
Q Lake Benbow
R Humboldt Redv
S Lower Eel
T Eureka Plain
U Cape Mendocin

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HYDROGRAPHIC UNITS AND SUBUNITS

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G Hayfork Valley
H Hayfork Creek
J Upper So. Fork
K Hyampom
L Lower So. Fork
M Willow Creek
N Hoopa

F 5 MAD RIVER – REDWOOD CREEK

Subunits

A Ruth
B Butler Valley
C North Fork
D Blue Lake
E Snow Camp
F Beaver
G Orick
H Big Lagoon
J Little River

F 6 EEL RIVER

Subunits

A Lake Pillsbury
B Outlet Creek
C Willis Ridge
D Bound Valley
E Wilderness
F Black Butte
G Etsel
H North Fork
J Bell Springs
K Sequoia
L Yager Creek
M Van Duzen River
N Larabee Creek
P Laytonville
Q Lake Benbow
R Humboldt Redwood
S Lower Eel
T Eureka Plain
U Cape Mendocino

F 8 MENDOCINO COAST

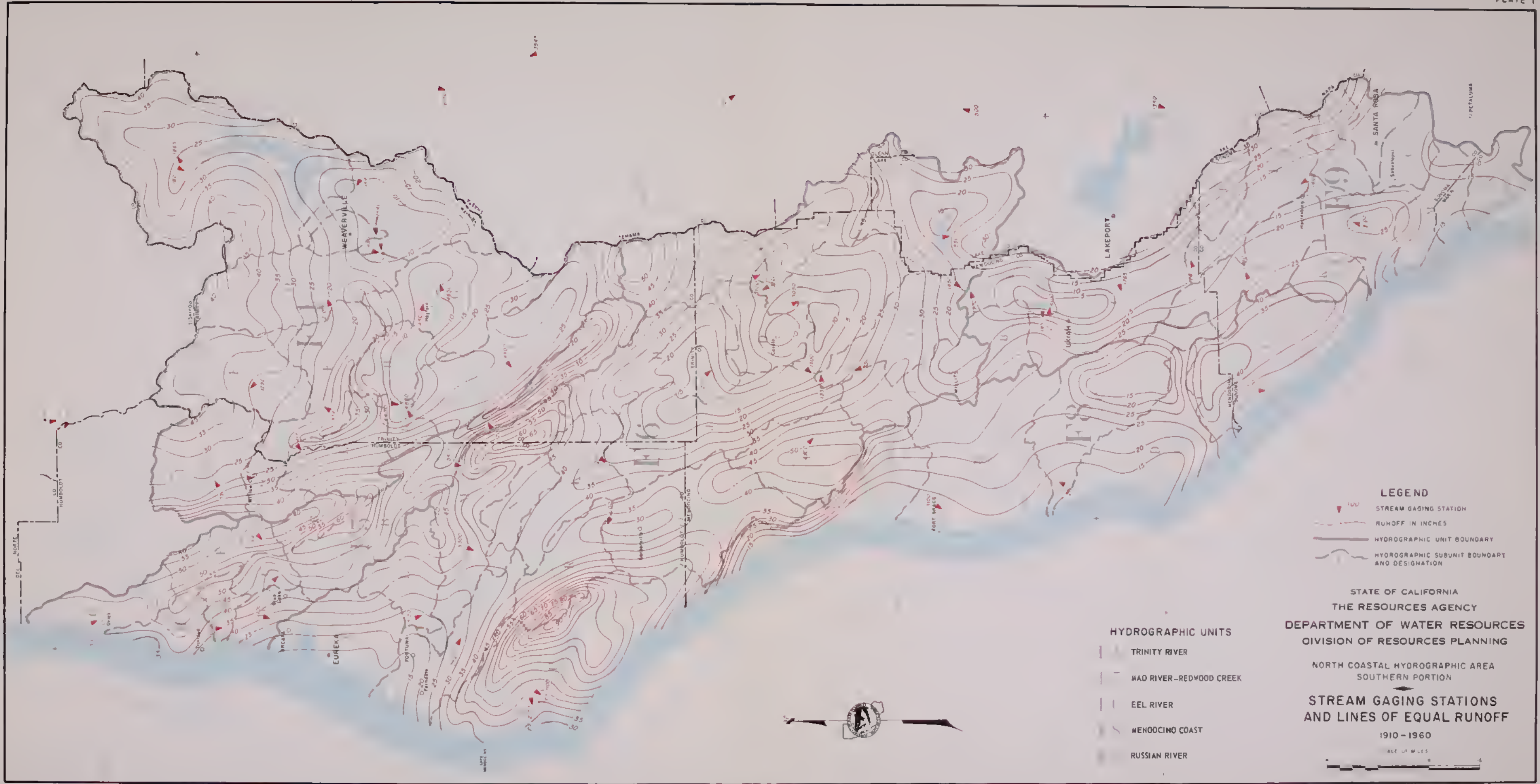
Subunits

A Rockport
B Fort Bragg
C Navarro River
D Point Arena
E Gualala River

F 9 RUSSIAN RIVER

Subunits

A Coyote Valley
B Forsythe Creek
C Upper Russian
D Sulphur Creek
E Middle Russian
F Santa Rosa
G Laguna
H Mark West
J Dry Creek
K Austin Creek
L Lower Russian
M Bodega
N Walker Creek



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F 4 TRINITY RIVE

Subunits

- A Trinity Reservo
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- U Cape Mendocino

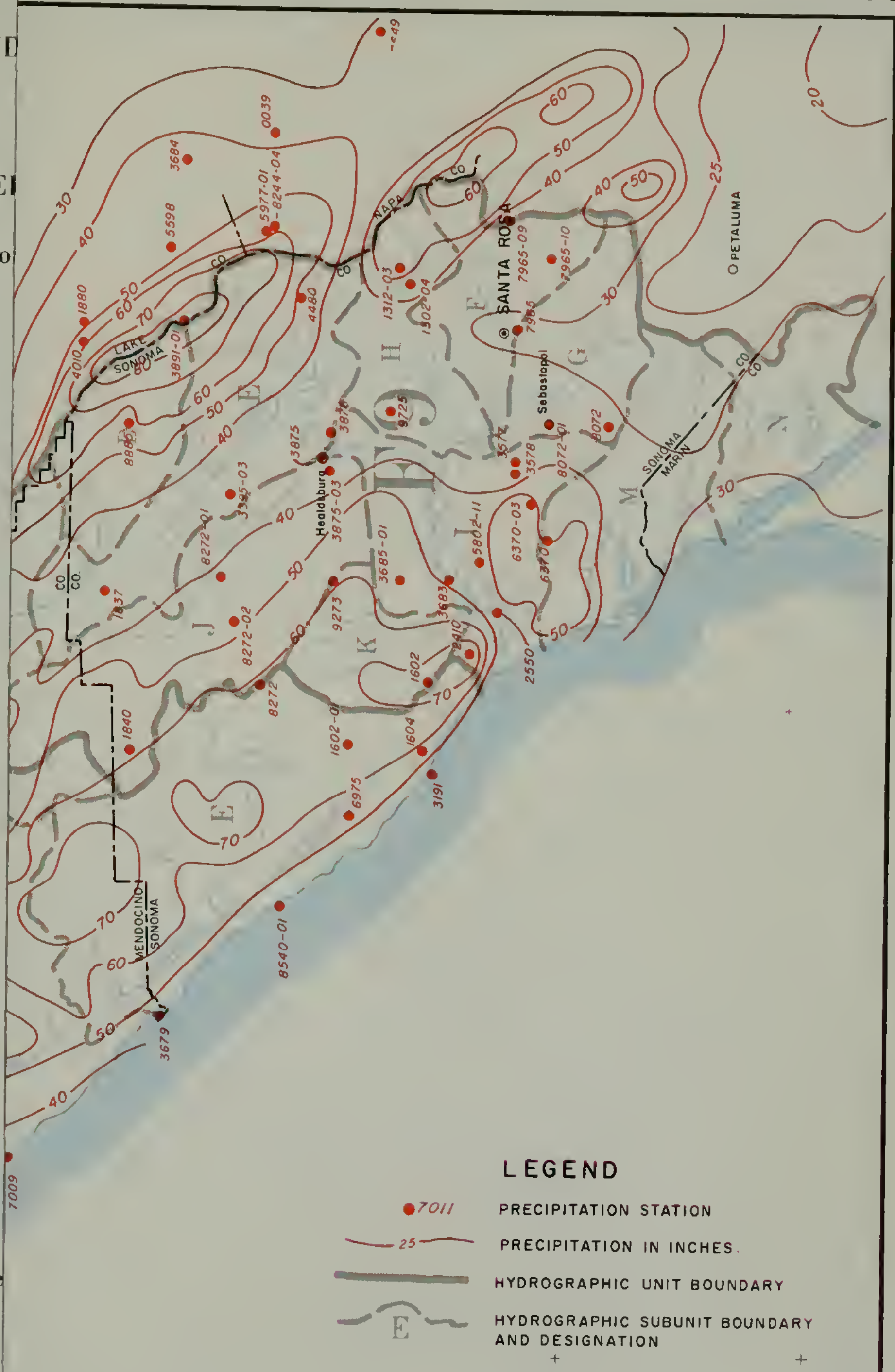
PHIC UNITS

ER

-REDWOOD CREEK

COAST

ER



STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

NORTH COASTAL HYDROGRAPHIC AREA
SOUTHERN PORTION

LINES OF EQUAL PRECIPITATION

1910 – 1960

SCALE OF MILES

8 0 8 16

HYDROGRAPHIC UNITS AND SUBUNITS

F 4 TRINITY RIVER
Subunits
A Trinity Reservoir
B Weaver Creek
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H Mark West
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K Austin Creek
L Lower Russian
M Bodega
N Walker Creek

ER BASINS

Y

LEY

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REA

RIVER VALLEY

D

T HYOROGRAPHIC UNIT

TED SMALL COASTAL
STREAM VALLEYS

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NORTH COASTAL HYDROGRAPHIC AREA
SOUTHERN PORTION

GROUND WATER BASINS

1910-1960

SCALE OF MILES

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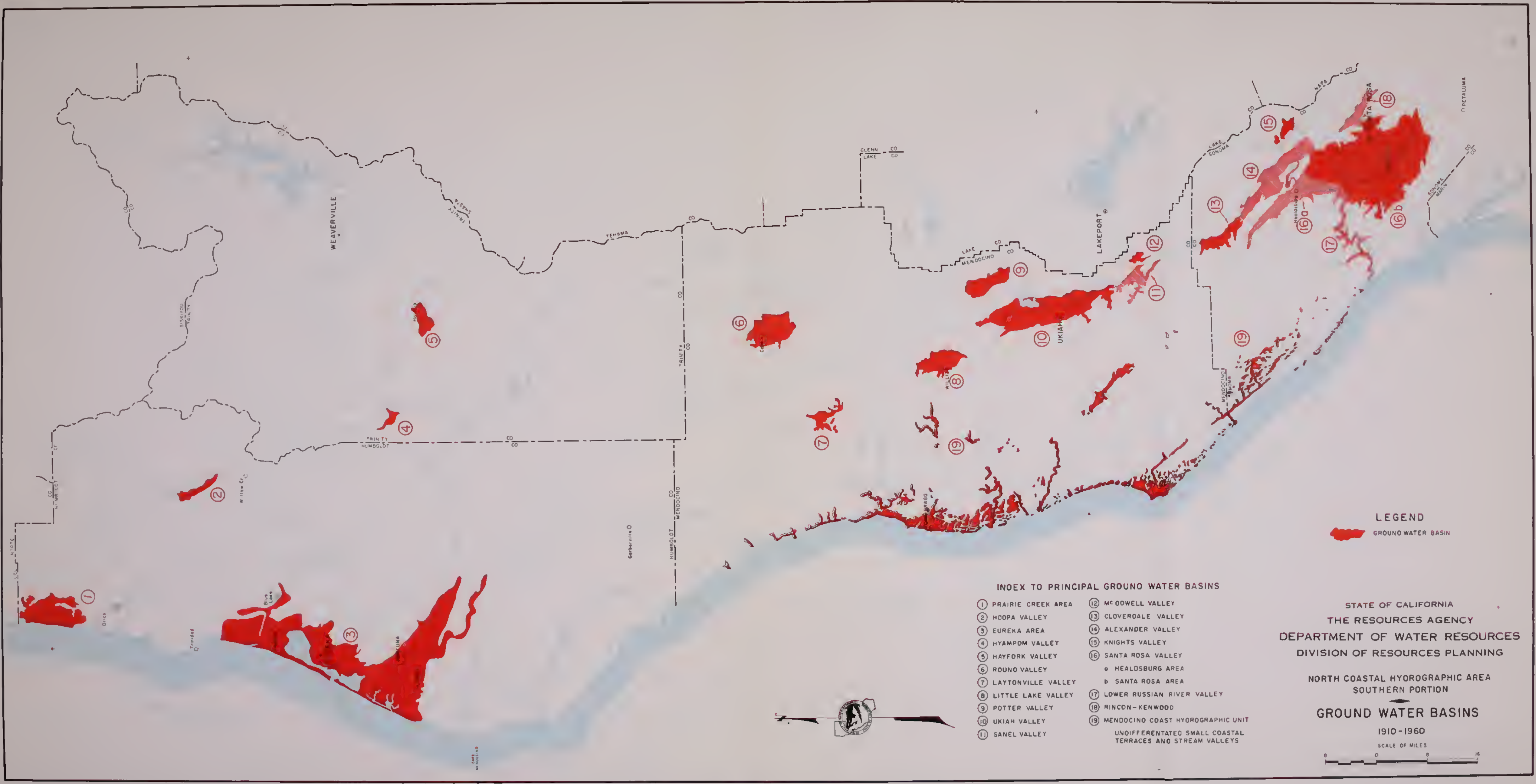
LEGEND
GROUND WATER BASIN
INDEX TO PRINCIPAL GROUND WATER BASINS
(1) PRAIRIE CREEK AREA
(2) HOOPA VALLEY
(3) EUREKA AREA
(4) HYAMPOM VALLEY
(5) HAYFORK VALLEY
(6) ROUND VALLEY
(7) LAYTONVILLE VALLEY
(8) LITTLE LAKE VALLEY
(9) POTTER VALLEY
(10) UKIAH VALLEY
(11) SANEL VALLEY
(12) McDOWELL VALLEY
(13) CLOVERDALE VALLEY
(14) ALEXANDER VALLEY
(15) KNIGHTS VALLEY
(16) SANTA ROSA VALLEY
a HEALDSBURG AREA
b SANTA ROSA AREA
(17) LOWER RUSSIAN RIVER VALLEY
(18) RINCON-KENWOOD
(19) MENDOCINO COAST HYDROGRAPHIC UNIT
UNDIFFERENTIATED SMALL COASTAL TERRACES AND STREAM VALLEYS
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